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Design of Ball Bearing Closures

By T. C. Delaval-Crow

Full value of ball bearings dependent on proper housings—Use of felt washers and oil grooves — Mechanical closures for horizontal and for vertical shafts — Stuffing boxes

THE USE of ball bearings by designers as a means of supporting rotating parts is, perhaps, first considered because of the power saving through the elimination of friction. There are, however, other important advantages.

Wear in a ball bearing of suitable size and correctly mounted is so slight that even after long service it cannot be measured. This allows simplification of the mounting by obviating the adjustment needed to take up wear. Again, the possibility of packing the bearings with sufficient lubricant to last for months at a time simplifies the lubrication problem.

In order that full value may be obtained from a ball bearing, attention must be paid to the means used to house the bearing, so that the lubricant is retained and dirt excluded. If dust, grit or other abrasive substances enter the housing and contaminate the lubricant, a lapping action will be produced which causes very rapid wear and premature failure. Water or corrosive fumes, if allowed entrance into the housing, will corrode and pit the small polished surfaces of the bearing parts and also lead to early failure.

The means of obtaining exclusion of foreign matter and retaining lubricant may be divided into the following five classes:

1—Felt closures
2—Plain oil or grease grooves
3—Mechanical closures
4—Combined mechanical and felt closures
5—Stuffing box type

The first and most commonly used, is the felt washer, retained in a groove under slight pressure. The felt used should be of pure wool and of a compact structure. Cheap felt will soon stiffen, pack, and so become useless. The width or size of felt used will vary with the shaft diameter because as the shaft surface speed increases, the wider the felt required to resist wear. Experience has shown, however, that as the design limits the over-all width of housing, it is best to select felts in relation to the shaft diameter, irrespective of the speed at which it operates.

The cross-section of the felt retaining groove must be so proportioned to the felt that the felt is compressed and a slight pressure is obtained between it and the revolving member, care being taken that pressure is not too great. Otherwise, heat will be generated and a groove worn in the revolving member. The felt should always, if possible, be a continuous stamped ring as, if made with a joint, the rotating parts will tend to open up the loose ends and so spoil the seal.

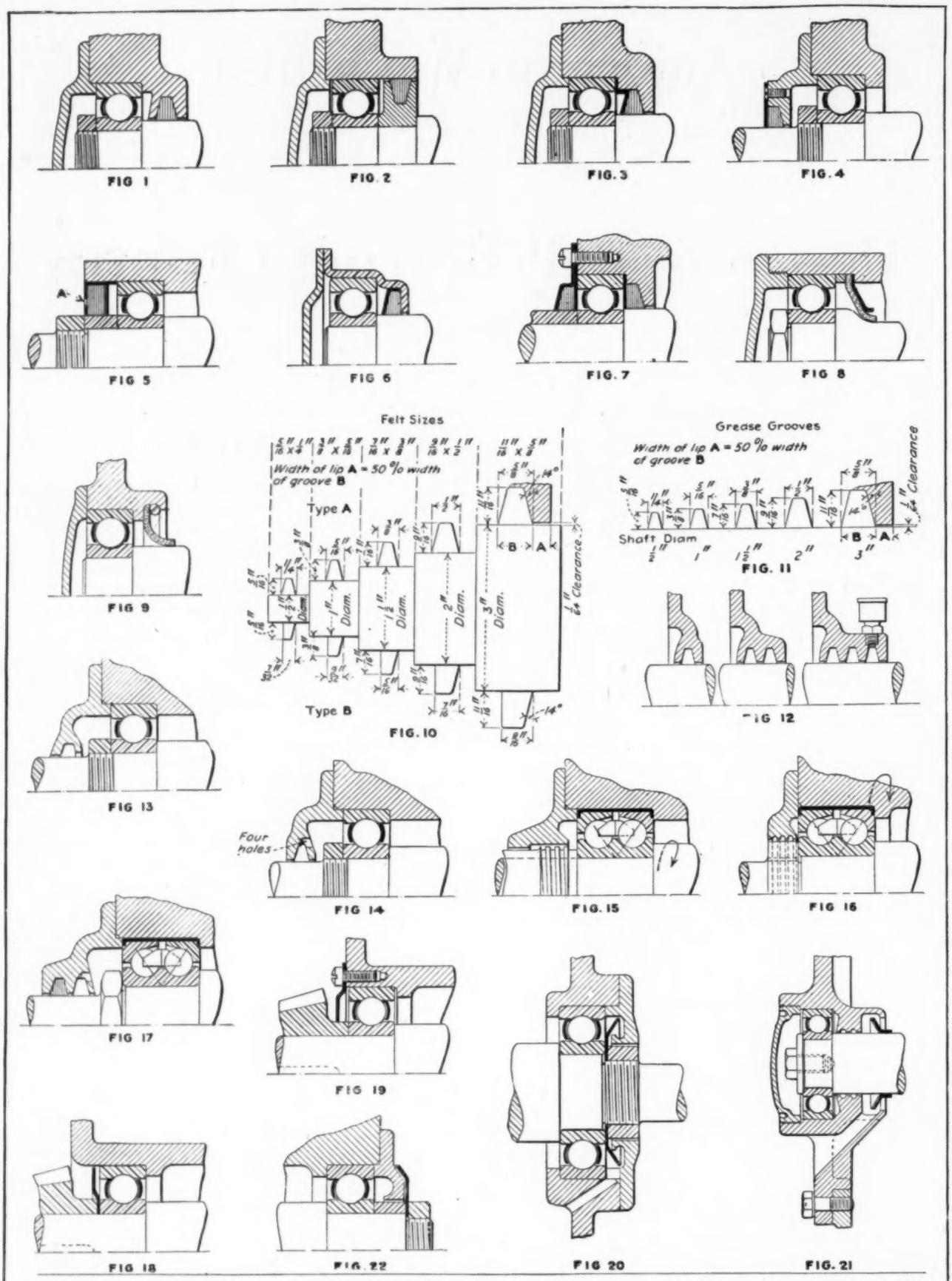
Felt Carrier Proportions

The felt groove can be cored, but a machined groove is preferred, since by this means an equal compression of the felt will be obtained, resulting in equal pressure on the rotating member. A running clearance of approximately $\frac{1}{64}$ in. on a side between the shaft and the felt carrier is recommended, the edge of the groove being left sharp. If the clearance is too large, the felt will extrude and wear quickly. Another advantage in the close clearance is that an additional seal is maintained between the shaft and the felt carrier due to an oil film being created between it and the shaft. If the clearance is made smaller than that mentioned, there is danger that, due to misalignment or deflection of parts, the shaft may rub on the bore of the felt carrier and so cause failure. The surface of the rotating parts should be machined or, preferably, ground smooth as any roughness of this surface will soon cause the felt to tear and wear.

The diameter of the joint between the felt and the rotating member should always be as small as possible, not only to reduce the velocity of the rotating surfaces, but also to give the smallest diameter for the dirt to enter or the lubricant to leak. Also, the action of centrifugal force on the lubricant will then tend to throw it away from the revolving point. The design shown in Fig. 1 is correct; the method in Fig. 2 should not be used.

The simplest form of felt retainer is shown in Fig. 1 but has the disadvantage that a continuous felt ring cannot be used or the felt replaced without tearing down the whole unit. Figs. 3 and 4 show the best type of felt retainer. In these, the felt replacement or assembly can be accomplished with the least trouble.

The pressed steel retainer shown in Fig. 5, while



Figs. 1 to 7—Felt packing. Figs. 8 and 9—Leatherpacking. Figs. 10 and 11—Felt and groove sizes. Figs. 12-16—Oil and grease grooves. Fig. 17—Felt and plain grooves. Figs. 18-22—Horizontal mechanical closures

effective and cheap to produce, has the objection that the inner steel washer is hard to remove without distortion, when it is necessary to replace the felt. This could be overcome if two small holes were punched, as shown at *A*, which would allow a punch to be used to drive out the inner washer and felt. Fig. 6 illustrates an interesting example of a pressed steel felt retainer.

An example of the use of a pressed steel felt retainer on a small bearing mounting is illustrated in Fig. 7. It should be noted that the shoulder in this case, against which the inner race bears, is made larger than the outside diameter of this race. This allows the inner diameter of the pressed steel felt retainer to be of such dimension that there is no danger of it hitting the inner race, even under endwise motion.

The seal in Fig. 8 is very effective at slow speeds, and consists of a leather ring butting under pressure against a taper shoulder on the rotating member, the tension on the leather being maintained by means of a thin spring washer. Care, however, must be taken to see that no sharp edges revolve against the leather or else it would soon be cut in half. In the case of this seal being used for small diameters, the tension spring need not be used as the pressure of the leather would be sufficient if it was cupped up and mounted as in Fig. 9.

Regarding the felt sizes for various shaft diameters, Fig. 10 gives the dimensions of felt and felt grooves, either for the plain groove, type A, or combined groove and steel washer, type B, the felt cross-section being approximately 40 per cent greater than that of the groove, so causing it to be compressed, allowing a slight pressure on the shaft.

The second, or plain groove, class of bearing closures is most effective at slow speeds, in which case grease is probably used for lubrication, the grease, under the pressure caused by the rotating parts, filling up the grooves and acting as a seal. The groove sizes recommended for different shaft diameters are shown in Fig. 11. One or more grooves may be used, depending on the operating conditions. In extreme cases three grooves could be used, the outer groove being filled with grease from a compression grease cup, as shown in Fig. 12.

For oil lubrication or conditions of operation at a temperature high enough to melt the grease, a plain groove may be used, but in this case, care must be taken to provide means of draining the lubricant from the groove. Otherwise, it will fill up and overflow. This drain must be of sufficient size to obviate any danger of it becoming clogged.

Means for Draining the Groove

Two means of doing this are shown in Figs. 13 and 14. In either case, provision has been made so that no matter in what position the housing or cap is assembled, the drain will always operate. In either grease or oil grooves, the bore of the housing should be $\frac{1}{64}$ in. larger on a side than the shaft, the corners being sharp and the width of the lip being fairly wide in order to increase the effectiveness of the seal, as mentioned in the case of the felt groove.

In the case of either grease or oil grooves, the caps or housings should be enlarged at the outer diameter in such a manner that sufficient space is left for the lubricant to be thrown out by centrifugal force. This space also acts as a settling chamber for the lubricant distributed by the rotating parts, allowing the pressure on the lubricant to be reduced, which, if not done, causes leakage at the junction of the groove and shaft.

Spiral grooves are sometimes used on the rotating member as shown in Figs. 15 and 16, the direction of the thread being such that the lubricant will be propelled towards the bearing. These, however, have the objection of expense and that the direction of rotation might be changed, draining the lubricant from the housing. Also, as the thread tends to screw the lubricant back into the bearing, it will also tend to carry dirt in the same direction. Grooves in the non-rotating member tend to clog with dirt, etc., thrown out by centrifugal force.

Combined Felt and Plain Groove

Combined felt and plain groove closure is sometimes used and is probably one of the most efficient of the simpler types of seals. The plain groove and the oil film around the shaft forms a seal and tends to drain the oil away from the felt, thus preventing the felt from becoming oil-soaked and acting as a pump by capillary action. The felt in this case is only used as a flexible seal to exclude foreign matter. Fig. 17 illustrates this method.

The mechanical closure class may be subdivided into two types—the horizontal spindle and vertical spindle. In either case the arrangements most often employed are either a thin disc, designed to throw the lubricant into a groove cast in the housing which returns it to the bearing by means of a drain hole, or else some type of labyrinth channel.

The simplest form of slinger is shown in Figs. 18 and 19, in which a steel disc is used to prevent too much lubricant being thrown by the gears into the bearing.

The true slinger type of closure is more complicated. An example of the simplest of these types is shown in Fig. 20 and is so designed that the lubricant is thrown off by the slinger but drained back to the gear case through the cored holes at the bottom. Since in this mounting the lubricant is supplied from the interior of the mechanism, no means is required to keep a supply of oil or grease in the bearings. In the case of armature mountings, oil or grease must be kept in the bearing housing and yet not leak out on the shaft. Fig. 21 shows how this is accomplished, the bearing housing being carried within $\frac{1}{64}$ in. of the shaft and forming a pocket which will allow the level of the lubricant to be above the center of the ball circle. Excess oil is carried along the shaft, thrown by the slinger into the cast groove, and drained out of the case by means of the cored hole.

When bearings operate under extremely dirty conditions, such as in grinding rooms or cement mills, it is more important that the dirt be excluded than that leakage of the lubricant be prevented. Under these conditions, a slinger should be placed on the outside of the housing, so tending to throw the dirt away by centrifugal force. Also, such lubricant as is thrown out by the slinger tends to help this condition. Fig. 22 illustrates this seal.

An interesting example of a seal which combines the advantages of a slinger for oil retention and also a means of dirt exclusion by centrifugal force is shown in Fig. 23. Another type of mechanical prevention of leakage is the labyrinth groove as shown in Fig. 24. However, the clearances have to be very small to be effective, not over $\frac{1}{64}$ in. and preferably less, so that

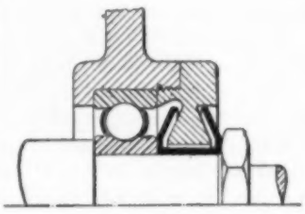


FIG. 23

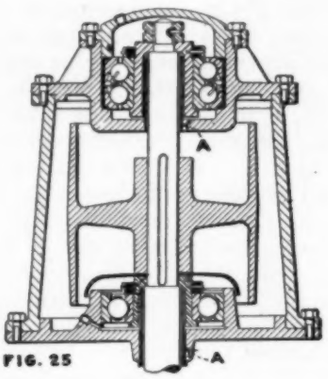


FIG. 25

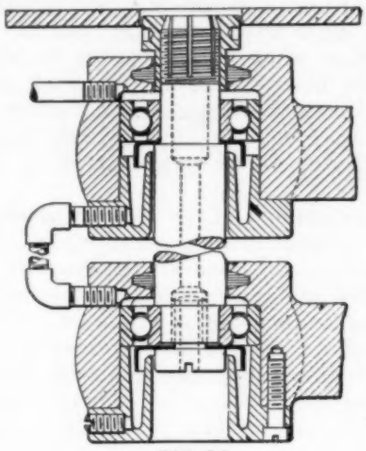


FIG. 26

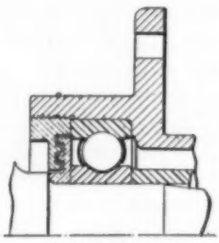


FIG. 24

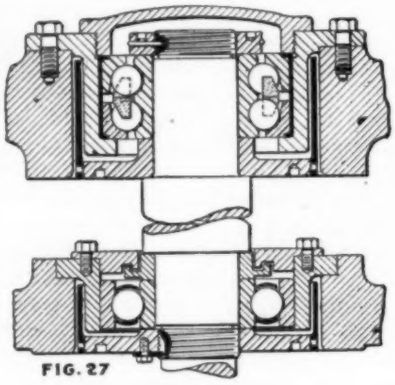


FIG. 27

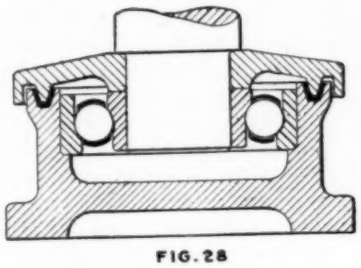


FIG. 28

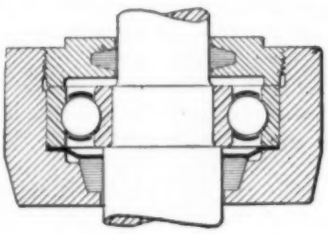


FIG. 29

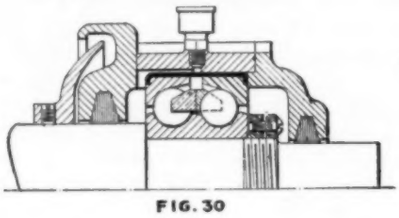


FIG. 30

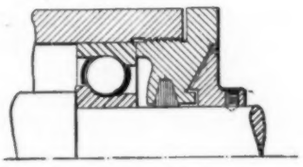


FIG. 31

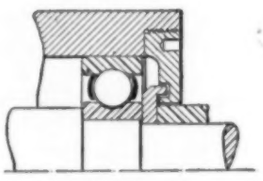


FIG. 32

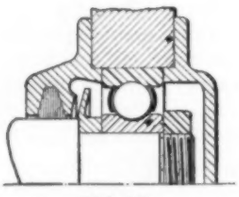


FIG. 33

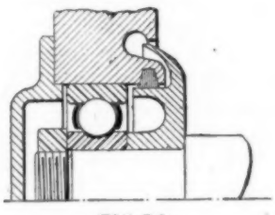


FIG. 34

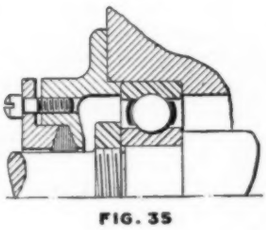


FIG. 35

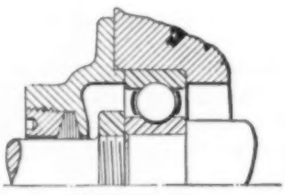


FIG. 36

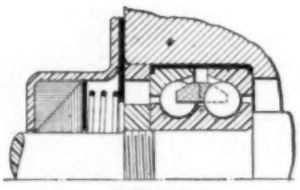


FIG. 37

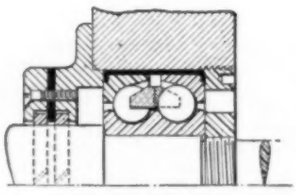


FIG. 38

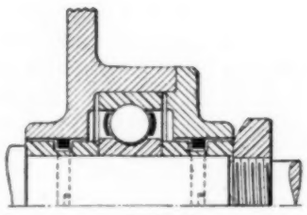


FIG. 39

Figs. 23 and 24—Horizontal mechanical closures. Figs. 25 to 32—Vertical mechanical closures. Figs. 33 to 35—Combined mechanical and felt closures. Figs. 36 and 37—Stuffing box type. Figs. 38 and 39—Piston ring packing

manufacturing cost is high and any misalignment of parts causes rubbing, wear and failure.

In the vertical shaft the problem of dirt exclusion may be solved by the same means as in the horizontal shaft, but lubricant retention is more difficult due to gravity causing it to flow down the shaft. Fig. 25 is typical of the general principle used for a vertical rotating shaft, in which tube *A* is stationary and of such height that the oil level is maintained above the balls. The pressed steel washer above the lower bearing acts as a slinger and keeps dirt from entering the housing. Fig. 26 shows the same type used with felt seals around shaft.

In Fig. 27 is given an example of rotating outer cup and attention is called to the use of the labyrinth seal at the top of the lower bearing. The use of oil as a seal from acid fumes, etc., is shown in Fig. 28. Care must be taken, however, to be sure that the oil in the groove is replenished from time to time.

Where a large supply of lubricant is not necessary, a felt packing can be used for a vertical shaft as illustrated in Fig. 29. The standard type of felt groove can, of course, be used but is not quite as satisfactory as that formed by an open groove and a steel washer. The slight spring in the steel washer causes pressure to be maintained on the felt and also allows ease of replacement of the felt washer at the point where maximum leakage occurs, due to gravity.

A combination of mechanical and felt closure is often used when the machine is subjected to considerable dirt and an atmosphere full of moisture and, perhaps, corrosive fumes. In such cases a combination of mechanical and felt seals can be used as illustrated in Fig. 30.

A seal consisting of labyrinth and felt, which has been used with success on grinding spindles, is shown in Fig. 31, the felt preventing oil leakage and the labyrinth thrower preventing entrance of dirt. It should be noted that the labyrinth disc is machined to a sharp point to act as a thrower, and thus tends to throw the dirt away from the opening into the labyrinth passage. Another illustration of the mechanical seal, and one which is used successfully on grinding spindles, is shown in Fig. 32. This type operates without felt and, therefore, overcomes heating due to the rubbing of the felt on the spindle.

Oil Slinger Combinations

The oil slinger principle is often combined with the felt groove as illustrated in Figs. 33 and 34. In the case of Fig. 33 the interior slinger prevents oil creeping along the shaft, the felt operating as a dust-seal. In Fig. 34 the slinger operates in conjunction with an interior felt and therefore, in this case, throws the oil which leaks past the felt into a drain which is open to the exterior of the machine.

The class of seal which is, perhaps, the least used is the so-called stuffing box type, which is illustrated in Figs. 35 and 36. This is practically the adaptation of the standard steam cylinder stuffing box to a ball bearing seal. European automobile designers often use a modification of this, in which a spring, as shown in Fig. 37, is used to keep the packing tight.

The least used, though perhaps the most effective is the piston ring packing as shown in Figs. 38 and 39. This seal will efficiently exclude dirt and retain lubricant under nearly all conditions and is, perhaps, not so costly to install as it at first appears.

In conclusion, it must be stated that a mechanical seal of the thrower type is probably the only seal which permanently maintains its efficiency under all operating conditions and, even though slightly more costly than the commonly used felt, will really pay for itself in excluding dirt from the ball bearings. This enables the user to obtain maximum life from the bearing which, if correctly installed and lubricated, will practically outlast any revolving part of the mechanism in which it is mounted.

Beauty in Machine Design

By Entropy

Beauty lies largely in the eye of the observer. Many years ago machine tool builders ornamented their machines with architectural monstrosities, and even in some cases with bunches of grapes and other fruit. The purchasers in those days considered these things artistic. They would not buy the machines without such embellishments.

The question before the designer today is not so much to meet his own idea of beauty as to discover what his customers think is correct. He finds very readily that we live in a utilitarian age. The purchaser declares that he does not want to pay anything for ornamentation. In spite of this declaration we know that the customer does pay, and pay cheerfully, for a considerable amount of painting that adds nothing whatever to the product he can get from his equipment. The cost of the many coats of filler, the rubbing down and all, amounts in some cases to as much as 10 per cent of the total cost of the machine. It has to be added to the price the ultimate user pays.

Now, if the user will pay for this smoothing out process, will he pay still more for graceful lines and artistic proportions? And if he will how can they be obtained?

One of the first principles of art is that the proportions of the principal mass must be right before any ornamentation is added. A library table must be about 6/10 as wide as it is long, curves must be on the so-called line of beauty or of the conic sections. Apply these things to a lathe bed. The first obstacle is that someone wants a lathe the bed of which is 30 feet long. We cannot very well make it 18 feet wide just so as to get the alleged artistic proportions. A lathe with a bed 30 feet long is a purely utilitarian thing. It is ugly, as ugly as a long straight street. But the street can be curved, not the lathe bed. The same thing applies to all other machine tools.

I sometimes go into a sculptor's workshop, studio he calls it. In the front room there are beautiful samples of his art, but in the workshop there are ugly pieces of rock just as they came from the quarry. His tools are not beautful, his hammers and chisels are the tools of the trade about as they were in King Tut's time, except that he has an air hammer. The lack of beauty in his equipment does not trouble him. He makes beauty to sell, he appreciates his own artistic ability but it does not decrease that artistic sense to work amid ugly surroundings, because the value of what he is doing is in his mind and eye from the time he knocks the first chip from his stone.

Machine tools are means to certain ends. Their use is necessary to almost every trade that produces beauty. They are the foundation of industry, but we do not feel badly to know that the foundation of a beautiful building is not intended for exhibition.

The Foreman and the Suggestion Box—Discussion

By W. Roland Needham
Essex, England

J. E. POWELL on page 942, Vol. 59, of the *American Machinist* passes several observations which are most apposite. This is particularly interesting to the present writer in that it was apparently an earlier contribution of his own that set Mr. Powell at work recording his personal experiences and registering his deductions therefrom.

Mr. Powell emphasizes not one whit too strongly that the management must of necessity be intimately associated with any suggestion scheme which is to function effectively. The existence, let alone the success, of any scheme at all must in the last resort—if not in the first instance—rest with the management. It is here that an alert, well disposed, sympathetic, broad-minded outlook and policy means practically everything so far as putting a project on a sound workable basis is concerned. The management which deliberately blocks the course puts the veto on any and every scheme. Should it be a question of a grudging accommodation the prospects are only a little better. But where the powers that be are willing to make an experiment and give it a fair trial, then there is reasonable ground for hope. If the men in the works and their foremen can be brought to see that suggestions are definitely welcomed, it ought to be possible to evolve a scheme that will work satisfactorily.

A Modest Start the Best

Those who are responsible for the drafting of the provisions would do well to remember that such undertakings should be allowed room to grow in. Nothing of the cut-and-dried order should be attempted. The framework is, of course, a prime necessity. At the inception, however, quite a modest program is all that it is necessary to offer. Also the promoters might do worse than solicit suggestions from those whom the scheme is intended to interest. It is not then altogether an affair of the other fellow's devising. Men are apt to favor the pets they have chosen, and to deal leniently with such shortcomings as those for which they are responsible. As time proceeds, improvements will almost automatically come into being.

The Manager's Duties

The management worthy the name will never seek to wrest what is really a trust from legitimate to unlawful uses. There are a few individuals who are base enough to do so, but in the long run they overreach themselves, and find circumstances too strong for them. For instance, the manager who loses one after another of his best foremen runs a grave risk of himself being hauled before his board of directors to answer certain questions he will find it hard to answer satisfactorily.

Further, those in authority, in most cases, know their subordinates' worth. They can gage their powers and soon learn their limitations. If the owners are wise, they will at once acquaint the foreman that they are pleased that his department has sent in a record number of acceptable suggestions. Whether the foreman is a contributor or not will not concern them. As long as he can produce good team work and inspire loyalty, he is the right man in the right job.

Where there is the will to obtain the best results on the part of both the management and the men, and where the subordinate officials are encouraged to stimulate the efforts of their respective teams, the suggestion scheme is full of promise.

Are You a "Come-iner" or a "Come-outer"?

By Harry Senior

Mankind in general, as well as every major and minor division thereof, has been so often "divided into two classes" by authors and orators, writers and speakers, scientists and politicians, that I sometimes wonder if there is a single, honest-to-goodness undivided individual to be found in the whole world. We have gotten so used to being sliced up in this manner, however, that another slash or so will not phase us, and I want to exercise my own prerogative as a sociological surgeon by performing the operation once more, choosing for my subject the group known as Industrial Managers.

In place of the "old man" who used to wear overalls and boss the whole works from the ground up, modern business has developed almost as many kinds of managers as it has engineers, each with his designating adjective of "Gen.," "Works," "Sales," "Adv.," etc., but for my purpose I will consider them all as a single unit and cleave that unit with one fell swoop into the two classes of "come-iners" and "come-outers."

I have been connected with the machinery industry for a good many years and, though I have never aspired to be a salesman, it has often been my duty—sometimes pleasant, sometimes otherwise—to call upon all kinds of managers, always endeavoring to leave more of value than I take away. It is the manner of my reception in the various places that impels me to make the division noted above.

The Difference Between a "Come-iner" and a "Come-outer"

When the young man or the young lady who has shifted his or her cargo of chewing-gum to port and disappeared with my card, comes back and says "Come right in, Sir; Mr. Smith will see you at once," or "in ten minutes" or "an hour," or whatever it is, I know that I am to meet a "come-iner" who will rise from his desk, extend his hand and say: "Hello! Senior, glad to see you" (whether he is or not, I forgive him the falsehood) and that the interview is going to be satisfactory, even if I *don't* get what I came for.

On the other hand, when the cargo carrier does not come back, but after waiting for a longer or shorter—usually longer—interval there appears unto me a portly personage, holding my card between his thumb and finger and looking at it as if it was a new kind of income-tax return blank, I know that I have already met a "come-outer" and feel that luck is against me.

I cannot swear that the attitude of a manager toward a caller of the exact nature of whose business he is uncertain has any psychological connection with the business he represents, but I know that I have met many hundreds of the cheerful, urbane, competent managerial "come-iner" whose business is ample warrant for his cheerfulness as well as an unequivocal testimonial to his competency.

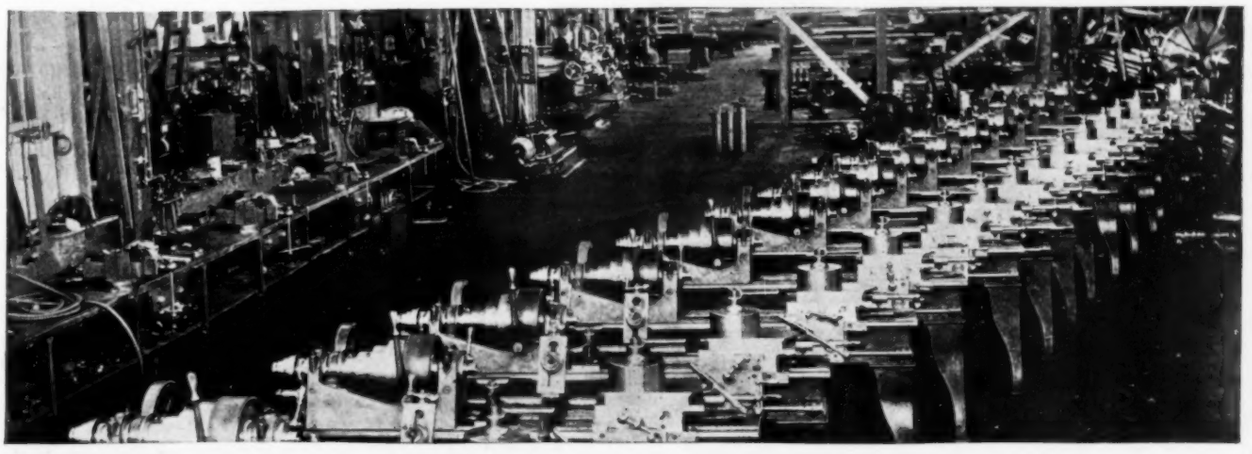
I have also met a few "come-outers."

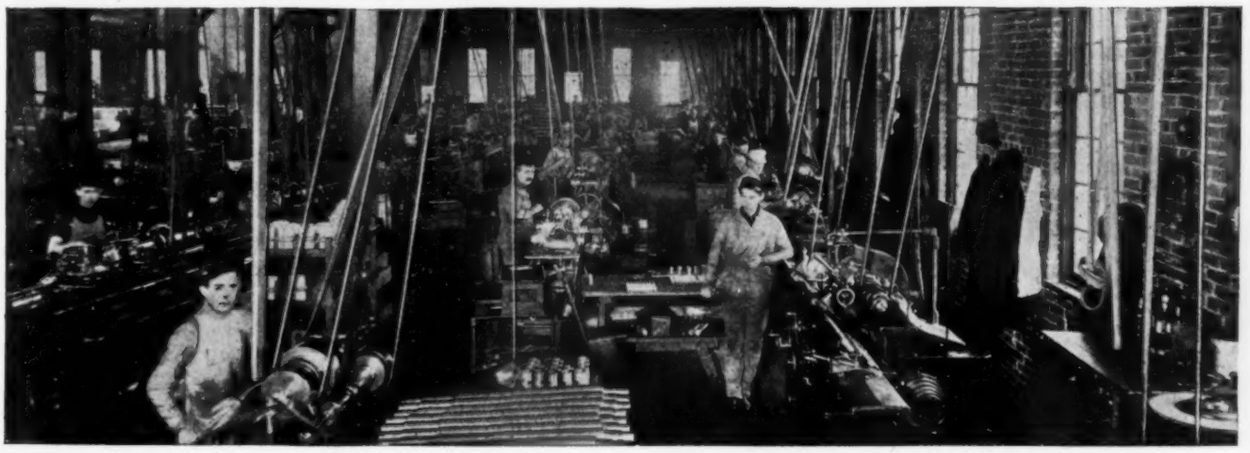
Where Machine Tools Are Made

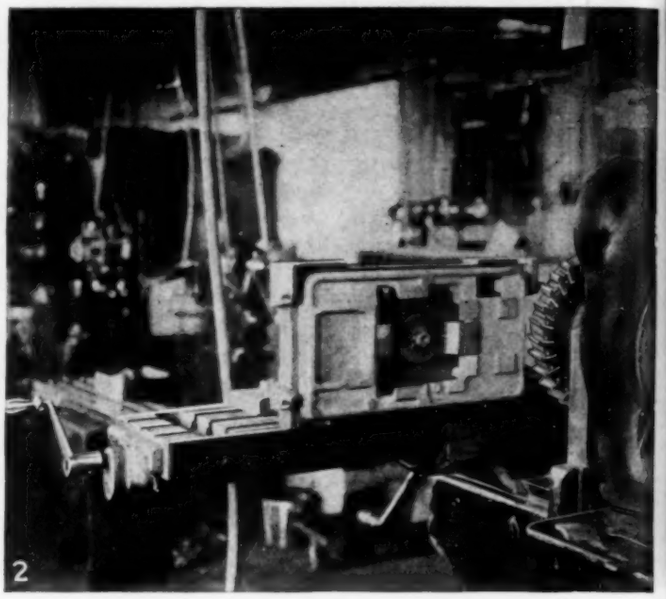
Springfield Machine Tool Company

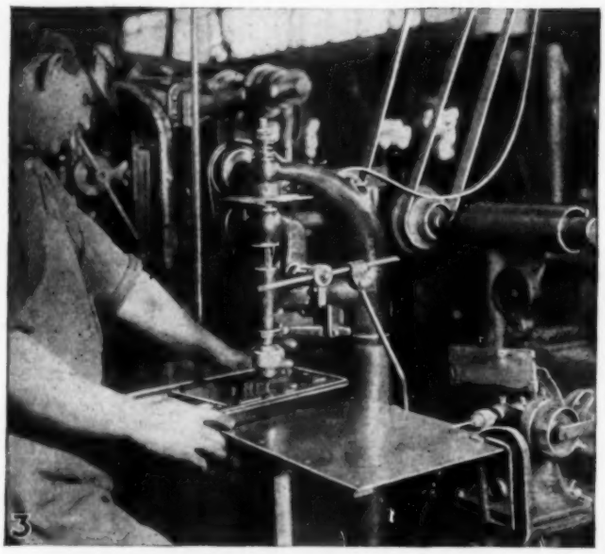
Springfield, Ohio

Founded 1887









Operations That Add to

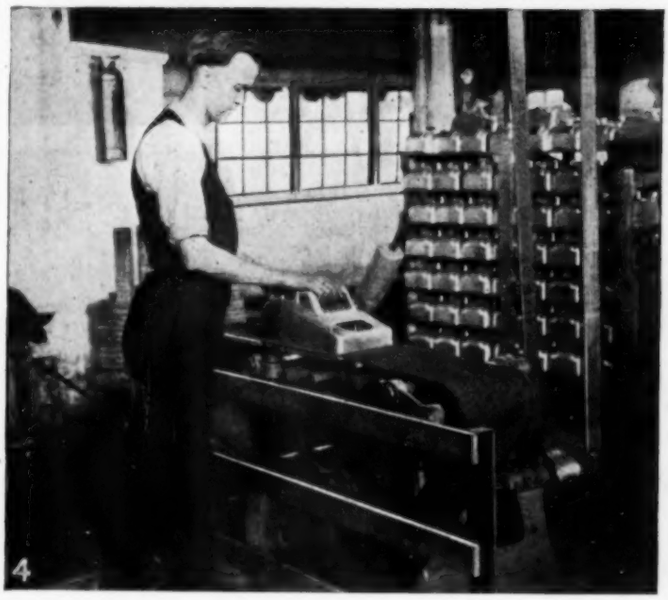
Fig. 1—The Sundstrand adding machine

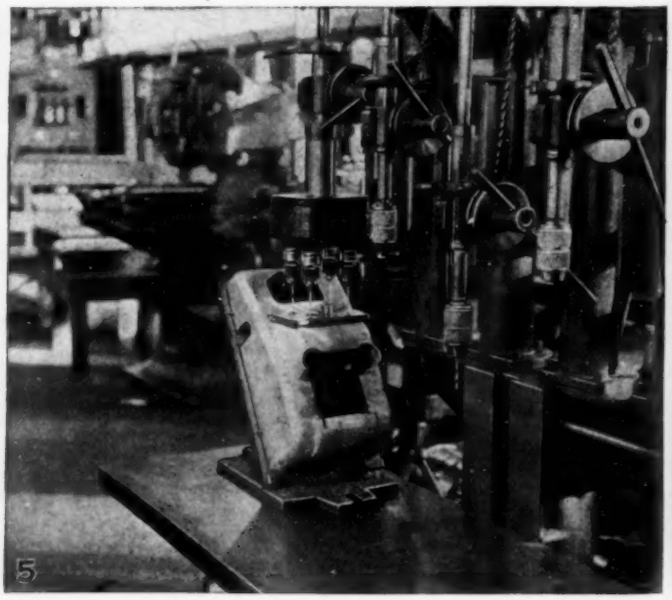
Fig. 2—Face milling the base

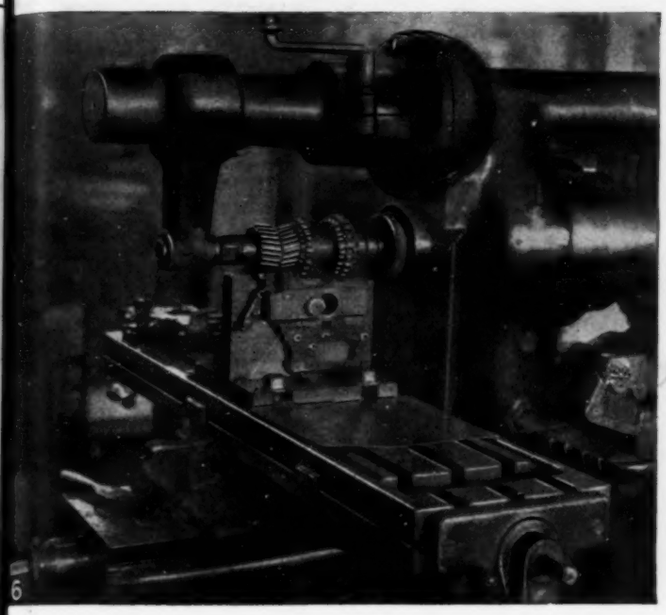
Fig. 3—Vertical and horizontal tapping machine for tapping 21 holes in face and end of base

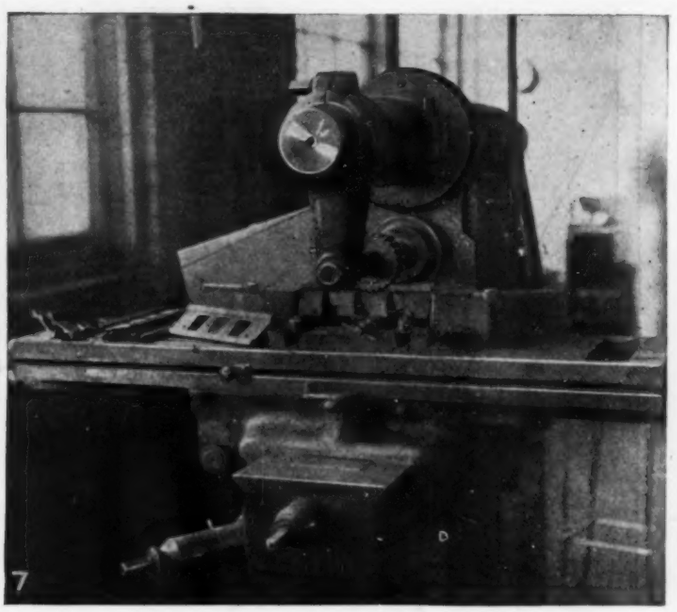
Fig. 4—Grinding bottom face of aluminum case

Fig. 5—Home-made drilling head for four $\frac{1}{8}$-inch holes in case









Adding Machine Accuracy

Photographs by courtesy of Sundstrand Adding Machine Company, Rockford, Ill.

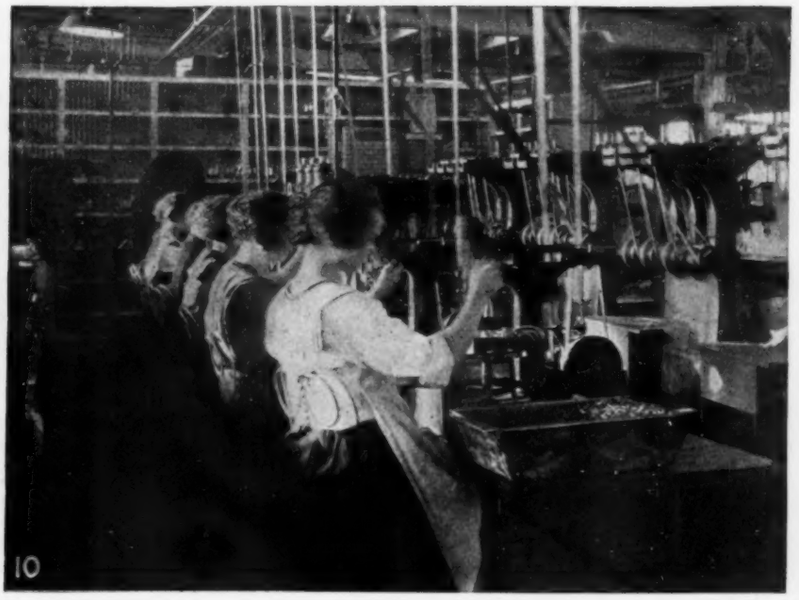
Fig. 6—Seven cutters milling carriage bearing points on side frame

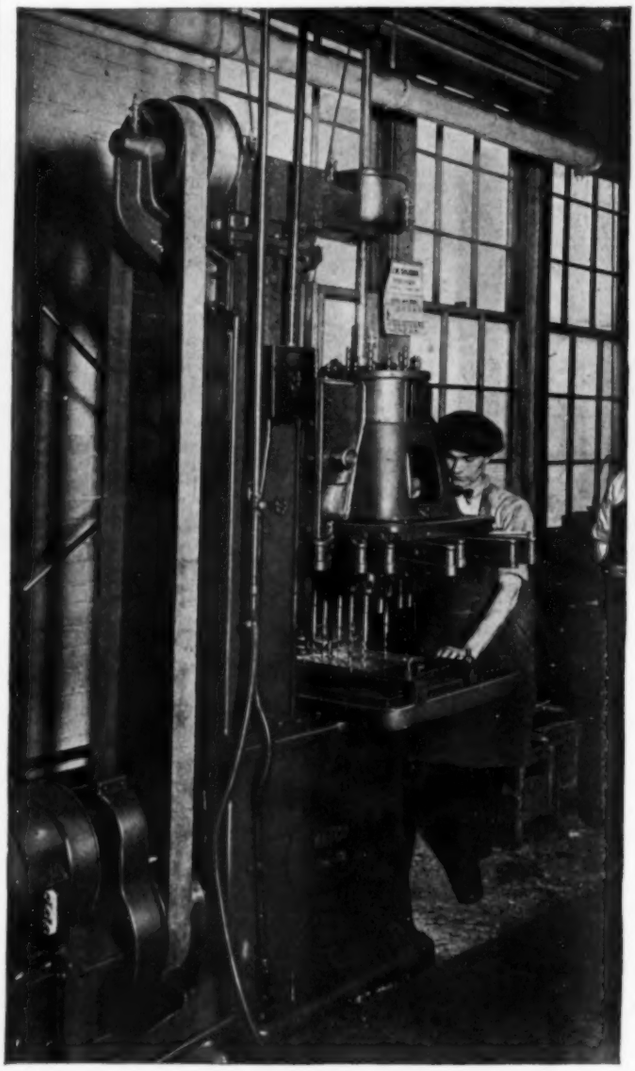
Fig. 7—Cam-action fixture for milling slides on paper carriage frame

Fig. 8—Home-made machine with two opposed spindles for grinding sides of 250 adding wheels per hour

Fig. 9—Testing type bar tail by gage

Fig. 10—Battery of small drills





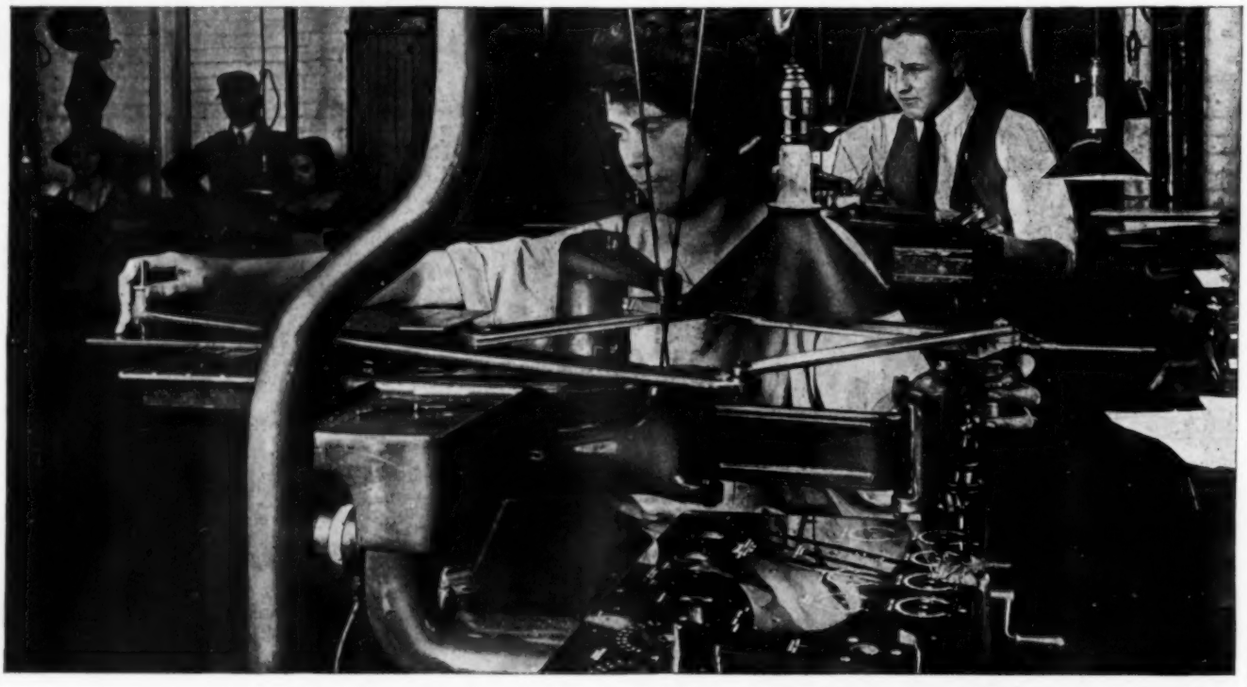
Radio Work

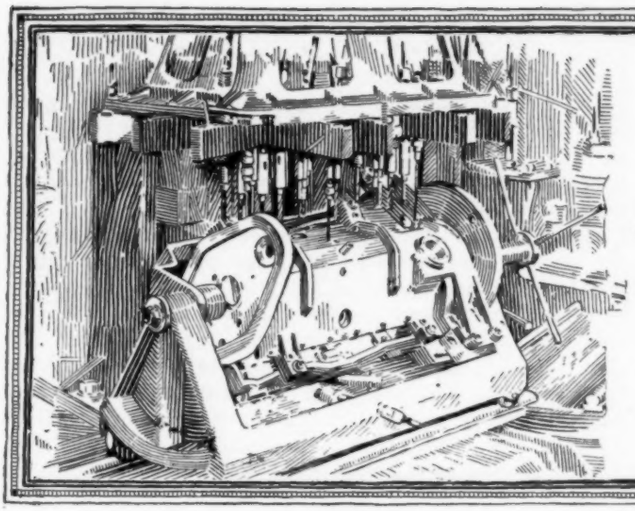
Left—Drilling 20 holes in a panel with a Natco multiple

Above—Stamping transformer cores on a Consolidated press

Below—Panel engraving with Gorton engraving machines

Photographs by courtesy of
Federal Telegraph & Telephone Co.
Buffalo, N. Y.





Tool Engineering

By

Albert A. Dowd

and

Frank W. Curtis

Points in the making and recording of tool drawings—Importance of neatness and uniform lettering—Methods of checking tool drawings

WE DO not think it necessary to dwell on the method of making tool drawings, but we believe the matter of lettering and the importance of good clear figures should be mentioned briefly. It is a very good idea for the tool designing department to establish a well-defined policy in regard to the form of letters used, their sizes and whether they are to be straight up and down or slanting. It is unfortunate that so many men who can make accurate drawings are poor letterers, yet this is often the case, and many a good drawing is seriously injured by poor letters and figures. Much can be done to improve this matter by establishing a standard and making the men live up to it. Instruct the checkers to criticise lettering severely, and insist upon the standard being maintained.

The same thing applies to the making of figures and dimensions, and it is surprising what a great difference in the appearance of drawings can be effected in a short time by rigid adherence to standard styles of lettering and figures. In general, mechanical drawings with straight up and down lettering using only capital letters, will be found easiest to read and best for the majority of work. Slant letters can be made somewhat quicker, but they are not quite as readable.

UALIFICATIONS OF A GOOD CHECKER

Only men of wide experience should be selected for checking tool drawings. In the first place, they should be good mathematicians and should preferably have had considerable shop experience, in order that they may be familiar with the practical handling of jigs and fixtures. Checkers should be able to analyze mechanical problems and solve them readily when required; and unless they are thoroughly practical as well as theoretical, the general effect on the tools will soon be noted. In addition to these qualifications, a good checker must be a man who takes nothing for granted and who proves every doubtful point before placing his O. K. on it.

It is our belief that there are very few really good conscientious checkers in the majority of drafting rooms, partly because the work itself requires a great deal of concentration and is generally avoided by men of sufficient ability because of its disagreeable features. The methods used by various checkers differ somewhat according to the disposition of the men and their ability. Many checkers go over a drawing and mark all necessary changes in blue or red pencil, thus making a great deal of extra work for the draftsman who makes the corrections, and incidentally causing him to take a strong dislike to the checker personally. This is

CHECKER'S SLIP (1)

JOB NO. 786	DATE RECD. 8/16-22
DWG. NO. A-2362	DATE STARTED 8/19-22
TOOL NO. T-327	DATE COMPL'TD. 8/19-22

CHK.	ITEMS
✓	Is design correct?
	Are all parts numbered?
	List of parts complete
	Quantity wanted correct
✓	Location of work
✓	Clearances around work
✓	Check with Opn. Sheet for finished surfaces
✓	Work properly clamped
✓	Can work be placed and removed easily
	Allowance for fit of work on studs, etc
	Overall dimensions on details
	Limits on important parts
	Treatment of materials
	Can worn parts be easily replaced?
	Job No. Correct
	Title correct
	Dwg. No. Correct
	Tool No. Correct

REMARKS:-

Fig. 589—Checker's slip used for tool drawings

For the authors' forthcoming book. All rights reserved.

always regrettable as it causes friction in the drafting room.

It is somewhat more trouble for the checker to use a carefully worked out system and a checker's slip like that shown in Fig. 589, but the results obtained are considerably better and there is less feeling of

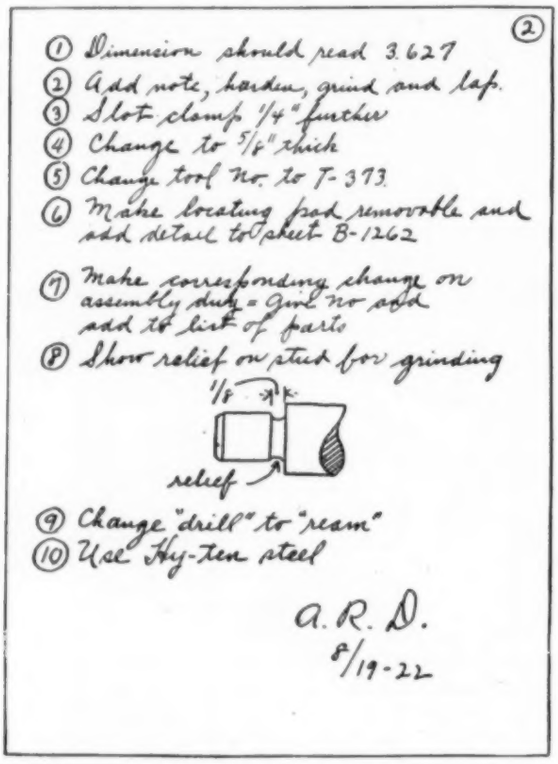

(2)
(1) Dimension should read 3.627
(2) Add note, harden, grind and lap.
(3) Slot clamp 1/4" further
(4) Change to 5/8" thick
(5) Change tool No. to T-373
(6) Make locating pad removable and add detail to sheet B-1262
(7) Make corresponding change on assembly dwg = Grind No. and add to list of parts
(8) Show relief on stud for grinding
1/8
relief
(9) Change "drill" to "ream"
(10) Use Hy-ten steel
A. R. D.
8/19-22

Fig. 590—Checker's slip to show changes necessary on tool drawings

dissatisfaction on the part of the tool draftsman. The checker's slip as shown is about 5x8 in. in size and printed on a cheap quality of paper preferably made up in tablet form. At the top of the slip general data in regard to job, drawing and tool numbers can be given in the form shown. A number of the most important matters are listed under the head of "items" in order that the checker may not forget them when looking over the drawing. These items can be added to if found advisable, but the list as given will be found fairly complete for the majority of tool drawings.

A check can be placed in the column provided for it after each item has been thoroughly covered. At the foot of the sheet there is a space for remarks which can be used for any important notes which the nature of the work requires. In checking large tool drawings which consist of a number of details, the checker's slip is supplemented by other sheets of plain paper filled in as shown in Fig. 590. On these sheets the checker writes instructions regarding necessary changes or dimensions of details and he numbers each of these changes in accordance with a pencil number which he has previously placed on the drawings themselves.

The man who makes the corrections should be the same man who originally made the drawings, in order that he may note his errors and avoid a repetition of them as far as possible on future work. The system of numbering the corrections leaves only a small amount of erasing to be done when making the changes, and the checker is able to follow out the corrections with very little trouble after they have been made.

All modern shops have a system of numbering all tools used, and this tool record must be carefully kept in order to avoid duplication of numbers. When the operation sheets are laid out by the planning department the tools needed must be specified, and a tool number given to each. The easiest way of keeping the records of these numbers is to use a book ruled up in the form shown at *A* in Fig. 591. A book is to be preferred to a card system for this purpose because there is less likelihood of an error in numbering. The tool numbers are entered consecutively in the column for the purpose, as shown in the illustration, and whenever a number is taken the name of the tool is entered on the book and a date placed in the proper column. No other information is necessary, as the principal purpose of this book is to serve as a check that tool numbers are not duplicated. As a matter of fact, some tool designing departments simply list the numbers in a column and draw a pencil mark through each one when it is used.

As a cross index on tool numbers a card can be used like that shown at *B* in the same illustration. The

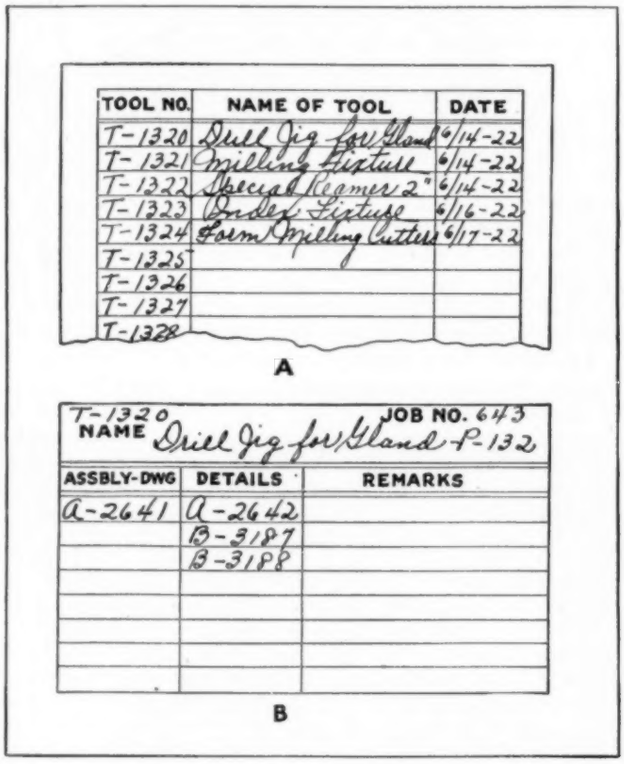
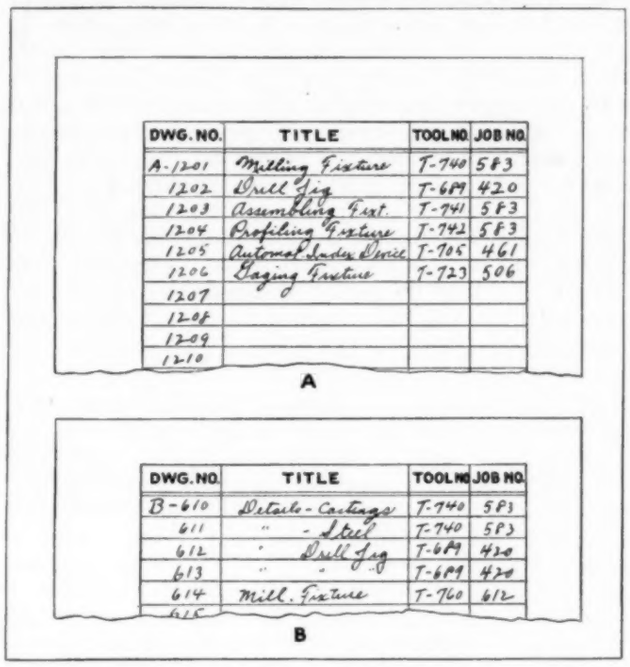


Fig. 591—Tool number records

purpose of this card is to show just what each tool number was used for and to give a list of the drawings and their numbers. In the example shown let us assume that the operation sheet calls for tool number T-1,320, and we wish to find the drawings for the tool. We look up the card T-1,320 and we find an assembly drawing A-2,641, and details A-2,642, B-3,187 and B-3,188. These drawings being of different sizes would naturally be filed in the cabinet according to the size of the sheet, and with this system they can be readily found when wanted. If desired, the tool card may

contain only the assembly drawing number, and a list of the detail sheets can be placed on the assembly itself. It is not a bad idea to have the details listed on the assembly sheet anyway, as this lessens the possibility of trouble which might be caused if the tool card were lost.

The same care should be used in recording drawing numbers as is used for tool numbers, in order to avoid



DWG. NO.	TITLE	TOOL NO.	JOB NO.
A-1201	Milling Fixture	T-740	583
1202	Drill Jig	T-689	420
1203	Assembling Fixt.	T-741	583
1204	Profiling Fixture	T-742	583
1205	Automat. Loader Device	T-705	461
1206	Gaging Fixture	T-723	506
1207			
1208			
1209			
1210			

A

DWG. NO.	TITLE	TOOL NO.	JOB NO.
B-610	Details - Castings	T-740	583
611	" - Steel	T-740	583
612	" - Drill Jig	T-689	420
613	" - "	T-689	420
614	Mill. Fixture	T-760	612
615			

B

Fig. 592—Method of recording drawing numbers in order to avoid duplication

duplication. A book is to be preferred to a card system for this work, and it may be ruled up as shown at *A* in Fig. 592. The *A* size drawings are listed consecutively, and a space is left for the title of the fixture; a column is ruled for the tool number and one for the job number. Whenever a drawing number is taken, the necessary data is entered on the books and nothing more need be done. The book should have a certain number of sheets devoted to *A* numbers, another set for *B* numbers and others for *C*, *D* and *E* numbers. The method of recording all these is exactly the same, and an example of the *B* sheet is shown at *B* in the same illustration.

Motor Vehicles on Railroads in South Africa

In the annual report of the general manager of railways and harbors of the Union of South Africa for the year ending March 31, 1923, it is stated that among the proposals at present under consideration for revising the cost of working branch railway lines is the provision of rail motor-vehicles to convey passengers, parcels, and light perishable traffic, according to the Automotive Division of the Department of Commerce. It is further stated that experiments are now being conducted with rail-motor vehicles on certain branches, and other self-contained units are on order or under consideration. Should it be seen that the utilization of self-contained rail vehicles is likely to result in the reduction of branch line expenditure, arrangements will be made to introduce the more economical method.

Why Not Use the Best Tool Available?

By A. L. DeLeeuw
Consulting Editor, *American Machinist*

ANYONE anxious to have a nice argument, guaranteed to last through a whole evening, can have it by asking this question: Should lathe and planer tools be sharpened in the toolroom or should the machinist do it?

There are still a good many people who believe that the machinist naturally knows best how the tool should be ground, and that he will be deprived of some of his "self-expression" if the tools are handed to him ground to standard angles. That one finds two machinists, side by side, doing the same work on identical machines but with tools ground in radically different ways, does not disturb our opponents at all. They seem to think that, just as two artists may use different brushes for their masterpieces, so mechanics may use different angles on their tools and do equally well. Please get this: Mr. A, who is brunette, five feet six inches tall, needs a tool with 20 deg. rake. This tool would never work for blond Mr. B, who is six feet two inches. His size would be 12 degrees.

No Choice in Drill Design

When it comes to the selection of other tools, we are less open minded. We do insist that the drill hand shall use twist drills. If he should argue that his personality requires flat drills (but he doesn't argue it) we would smile, say "All right," and hand him a twist drill just the same. We go further; we may leave the sharpening of the drill to him but when it comes to thickness of web, width of land, or spiral angle of the flutes, we leave him no choice. We give him what we have.

This is really much worse than the standardized lathe tool. With the lathe tool the workman has no choice; however, the management, be it foreman, superintendent, or engineer, can at least prescribe how the tool shall be made or ground. But when it comes to the twist drill even the management must take the thing as it is. It is a standard commercial article, it pays no attention to personal preferences, idiosyncrasies or theories—and does very well at that. The twist drill has been studied by users and makers, especially by makers, and a product has been developed which does the most good in the greatest number of cases.

How is it with other tools? Milling cutters for instance. In 1907 all commercial cutters were made with narrow tooth spacing, without rake, and, if provided with spiral teeth, the spiral angle was 10 deg. as a rule.

Wide Spaced Cutters Arrive

In 1908 wide spaced cutters were brought out and rake was introduced. Somewhat later the spiral angle was increased to 25 deg., and it was shown that, when this angle was used chip breakers were unnecessary; worse than that, they were a detriment. These things were not seriously disputed and in the course of time various makers of milling cutters brought out wide spaced cutters and gave them a place in their catalogs.

It might be expected that now in 1924, this style of cutter would be found in all up-to-date shops and that, in view of their greater efficiency all cutter makers

would give them a place on the front pages of their literature but this is not the case. Very often they appear only as "also present."

The old conundrum of the hen and the egg might be applied here. Don't the makers put more force behind the modern tool because the shops are buying more old than new style cutters, or do the shops do this because the makers haven't brought the facts home? And here is one of these facts: The best performance shown by a cutter without rake, with 10 deg. spiral angle and $\frac{3}{8}$ in. spacing was the removal of 0.44 cu.in. of steel per net hp. A cutter of the new style, that is with approximately $1\frac{1}{8}$ in. spacing, 25 deg. spiral angle and 15 deg. rake removed 1.26 cu.in. of steel per net hp.; the same steel and the same machine.

Of course, there is still a place for the old style cutters just as there is still a place for the flat drill or the one lip drill, but there seems to be no reason why the new style should not be made the standard. If there is cause to modify some of the elements, very well, let us modify them, but let whatever style we select as the best be our standard. All others may "run also." As a matter of fact, a great number of the more progressive shops have adopted the new style cutter as their standard but there are many factories where efficiency of the tool is never considered. They drift on the current of old practice and, quite often, land in the reeds where even drifting must stop.

Not more than five years ago a salesman of one of the well known cutter makers tried to interest me in his cutters. He told me how his concern was strictly up to date. They made wide spaced cutters, and they made them with the shovel. I was puzzled for a moment but soon concluded that he had some garden implement in mind but had picked out the wrong one. He may have meant "rake." Isn't it about time that the users of milling cutters should study the action and efficiency of the tool; that the cutter maker should instruct and educate his customers and recommend what is best, and that the cutter salesman should be made to realize the difference between a hoe, a shovel, and "rake"?

Light—the Big Factor in Safety

By Lloyd S. Graham

WHAT is the greatest single factor for safety in machine shops?

That question was asked a man who is the executive officer in an Eastern plant which manufactures a large number of different articles. This particular officer has charge of maintenance and, since the plant employs several thousand men and women, many of whom are machine operators, the machine shop is one of the most important parts of the maintenance department. This man had not only had charge of the immediate supervision of the plant machine shop for several years, but he had had earlier experience in machine shops, had been for several years a student of industrial safety, and could speak from the viewpoint of the employee as well as the employer.

It will be seen that he was fully qualified to answer that question—and he did answer it in one word.

"Light."

He went on with an explanation.

"That may sound rather unusual but I can truthfully say that I believe light more than equals all other factors for safety in machine shop management. This is an old plant and when I came here I found the machine shop tucked away with only small windows in the outside walls, and the scanty artificial light which was available was necessary on all but the brightest days. The windows were dirty and grimy. The place was dirty. A person was liable to stumble over tools or castings almost anywhere and minor accidents were not infrequent. Look at the place now."

The shop was now light; it was also clean; order prevailed and it had a clean-swept, neat appearance. The day was somewhat cloudy outside, yet no artificial lights were on, except two in the rear of the shop.

It seems that this executive had not been on the job very long before he had most of the outside wall of the machine shop entirely torn out, and tall windows put in in place of the wall. The artificial lights were entirely re-arranged and supplemented, with a view to having the light directed upon the work in the most advantageous way. There were now no unseen tools or other objects on the floors to be stumbled over, and there would have been no stumbling if they had been there, because they would have been in plain sight.

"Keeping a machine shop with a view to safety and the highest possible point of efficiency, to say nothing of the comfort of the employees, is much like keeping a house," this executive explained. "A light house is usually a clean house and the same is true of a machine shop. There is no debris or material hidden here in the shadows for anyone to stumble over, and our minor accidents are reduced to practically nothing. A major accident is almost unknown and the production, together with the accuracy of detail in production which is such an important thing in the machine shop, is much better since we installed proper lighting.

"The proper placing of an artificial light is a most important thing in a machine shop. Individual lights should be maintained at a proper height in relation to the worker's eyes. The light must be strong enough for a man to properly define his work and should be shaded so as not to strike directly at his eyes, particularly on bench work. It should also be located so that it will not cast a shadow upon the floor at the edge of the bench, preventing clear observation beneath the bench where tools or materials may be dropped.

"I have proved positively that light will increase production, that it assists in accuracy, and that good light is one of the best ways of conserving skilled machinists. Poor light often means defective eye-sight which may, in turn, mean the loss of a valuable man or the loss of time. It costs a lot of money to train a man for a job out here.

"Personally, I believe in individual motor drives for machinery in a shop of this type. Shafting, pulleys and belts have their place in industrial production, but in a machine shop, shafting, pulleys and belts make for confusing shadows. They also keep the dust continually stirred up and dust is a real health hazard in a machine shop. In general, the accomplishments that are possible with proper lighting depend largely on the characteristics and lay-out of the individual shop but I believe it is safe to say that a large percentage of the machine shops of the country could improve their lighting facilities, natural as well as artificial, in such a way that their insurance premiums would melt, and the employees would produce more and better work and be happier."

The Export Problem of the Machine-Tool Industry

By W. H. Rastall
Chief of Industrial Machinery Division, Bureau of Foreign and Domestic Commerce

Effect of the war on industrial machinery exports—Practical elimination of Germany as a competitor—Distinction between markets for general-purpose and for production types of equipment

THE WAR probably affected the machine-tool industry as much or more than any other, and this is especially true as applied to the export situation. Machine tools were required for the production of an endless variety of commodities as needed for military purposes. The allied blockade prevented the further export of such equipment from Germany even had the military requirements on this industry been such as to allow these German exports to continue. A similar demand was felt in the United Kingdom, but strange as it may seem, statistics show that throughout the war exports continued at about the prewar rate. On the other hand, the entire world called upon the manufacturers in the United States for a very greatly increased volume of machine tools, and our exports expanded rapidly from the volumes previously indicated to a total of nearly 85 million dollars in 1917. Upon the entry of the United States into the war about this time, it became very much more difficult to handle this export trade, in part at least because of the export markets and licensing provisions that were put in effect; and from 1918 the trade decreased to about 52 million dollars. Following the armistice, it expanded again to about 59 million dollars in 1919, since which time there has been further decline, and the return for 1923 show this export trade at about 12 million dollars, or slightly under the prewar level.

German Competition Dwindling

With regard to our German competitors, it is difficult to present a concise statement that is fully satisfactory, largely because statistics of figures expressed in marks are practically worthless because of exchange fluctuations, and returns on a tonnage basis are also unsatisfactory because the machine-tool manufacturer produces an article that can scarcely be described in terms of weight. However, it can be stated that during the war the German export trade was very largely wiped out by the allied blockade. Following the armistice an earnest effort was made by German manufacturers to recover their old position, but many circumstances have arisen to make this difficult. Through 1921 and 1922 it was felt that the depreciating mark gave German manufacturers a peculiar advantage in the world's markets for such equipment, and, to a certain extent, these influences continue even now. On the other hand, it should be emphasized that information reaching Washington indicates that these reports have been very greatly exaggerated, and while it is entirely true in many instances that German machinery has been sold at prices 50 per cent or less than corresponding American quotations, it still remains true that the actual volume of German metal-working machinery shipped into the world's markets has not been very large, at least not so large as many of the reports in the press would lead us to believe. It is perfectly true that the situation is one that would cause the American machine-tool exporter a great deal of annoyance and worry, and undoubtedly in a number of markets stocks of German machinery are carried at prices represented by the depreciating mark which will interfere with certain classes of trade for some little time to come. However, it is gratifying to add that late in 1923 the utter collapse of the mark resulted in conditions that make it very difficult for German manufacturers to continue this trade. The indications are that German costs are now above world-market levels, and until conditions change in Europe, it is to be assumed that German competition has lost its force. As a consequence, in 1924 we find a situation where, generally speaking, the world's machine-tool trade is in the hands of British and American manufacturers. For this reason it is particularly interesting to give close attention to the competition to be expected from British sources.

According to our figures, British exports have risen from the five-million-dollar level of 1913 in a more or less irregular way to about 12 million dollars in 1920, since which time there has been a decline and, at the close of 1923, these exports were approximately on a seven-million-dollar basis.

Propaganda for British Tools

When traveling in the machinery markets of Asia or Latin America, one frequently encounters remarks that would give the impression that the British machine tool is greatly superior to the American product. In the newspapers of China or the Malay States one will frequently find articles calling attention to the great weight of a British machine tool, and while these articles rarely mention American products it is

Abstract of a paper presented at a joint meeting of the Engineers' Club of Philadelphia A.S.M.E., Philadelphia Local Section, and the Machine Shop Division of the A.S.M.E., at Philadelphia, Pa., on March 25, 1924.

often implied that machinery from this country is too light. It is therefore interesting to note that in prewar years Germany was our best export market for metal-working machinery, taking on the average about 2¼ million dollars' worth of such machinery each year, and England ranked second, taking more than 2 million dollars' worth each year. It is a striking testimonial to the superiority of American metal-working machinery that these European countries absorbed such important volumes of this equipment in prewar years. It may be also added that during the war England imported nearly 20 million dollars' worth of such machinery in a single year. The fact that the British have found it desirable to import such large volumes of American metal-working machinery during the prewar, war, and postwar periods should in itself be sufficient demonstration of the superiority of American machinery of this kind, and provide adequate answer to the articles published in the press of Asia and elsewhere from time to time. However, the fact remains that, speaking generally, in earlier years British and German machinery have been of less highly developed types than that produced by this country. These European designs were frequently general-service tools, while the tendency in the United States was to produce a manufacturing tool, or even a single-purpose tool. Consequently, in the particular sense, the sales problem in the non-European markets frequently involved furnishing general-service tools suited to their requirements, and in these markets the American manufacturer seems sometimes to have missed his opportunity through offering equipment scarcely adapted to the needs of the individual buyer.

It is therefore obvious that in the cultivation of their foreign markets careful discrimination should be exercised by American machine-tool manufacturers between the European and the non-European demand. Obviously, manufacturers of production tools will find almost no demand for their equipment in Asia, Latin America, Australasia, or Africa. Their export interests lie almost exclusively in Europe. As a class, these seem to be the manufacturers who have made the best export showing. Conditions in Europe during recent years have seriously interfered with this trade, and there is little that can be said on the subject until Europe starts to recover from the war.

The Big Opportunity of 1924

The outstanding opportunity for export business by American machine-tool builders in 1924 appears to be that for the American manufacturer of general-service tools as in the non-European markets, and these remarks apply to manufacturers of accessories as well as to the producers of tools themselves. The non-European markets have become very much more important than in prewar days. German competition for the time being is of little consequence, and the trade in these territories will fall into the hands of British or American manufacturers. The problem before the individual American manufacturer is to so cultivate these markets as to insure the sale of his equipment there. Inasmuch as European designs ordinarily represent less highly developed machines than those produced in this country, they can usually be offered at lower prices, and if the buyers in these markets are left to their own devices, it is probable that they will purchase European tools because of attractive prices and with more or less disregard to quality. The American machine tool because of its superior engineering merit must command a higher price, and it is therefore up to the American manufacturer to make provision for such educational campaigns in these territories as will ensure intelligent buying on the part of the more or less inexperienced industrialist of these non-European countries.

Two Types of Markets

The opportunities for 1924 appear to lie particularly in two directions—first, in those markets which were formerly largely under German influence, and second in those markets that are showing natural expansion. It would appear that conditions are such that for some time to come difficulty will be experienced in securing satisfactory machine tools at commercial prices from German manufacturers. In prewar years such countries as Dutch East Indies, Chile, and several others depended very largely upon German sources of supply for machine tools. Now that it is difficult to continue this trade, it is believed that the American manufacturer has a peculiarly favorable opportunity for sales effort in those markets, and every effort should be made to take advantage of this opportunity for the proper introduction of American machine tools in those markets. In markets that are showing natural expansion such as Japan, Central Europe, and British India, there is also a special opportunity. Recent experiences in some of these markets indicate quite clearly that American machinery is not as well supported as its engineering merit deserves. In 1918 the United States furnished about 80 per cent of the machinery imported into Japan. More recently this participation has declined very seriously. In British India in certain years the United States furnished as much as 25 per cent of the machine tools. This percentage has also declined of late and, inasmuch as these ratios in no way express the comparative engineering merit of the machinery offered, one would infer that the American trade suffers because it is inadequately supported by constructive salesmanship.

This is a matter of really serious importance to the individual machine-tool manufacturer. Statistics covering the year 1921 indicate that the average American machine-tool builder exported more than 20 per cent of his product, so that export business for the industry represents to a large extent the difference between prosperity and depression. There is reason to believe that at the present time the average American manufacturer of general-service tools and machine-shop accessories should export well in excess of this ratio, and those manufacturers who are falling behind this standard will find it very much to their advantage to arrange for a careful revision of their export methods. Fortunately, it is comparatively simple to do this as experience shows that products of this character are sold in these foreign markets through machinery dealers residing in their important cities. The sales problem narrows down to that of establishing contact with some machinery dealer in each city who will be prepared to handle distribution of the product, and while it is perfectly true that in many instances difficulty will be encountered in establishing such contacts, it is probably more than equally true that methods can be found that will yield results far better than have been secured heretofore. Conditions in 1924 offer a most unusual opportunity for the manufacturer of general-purpose tools in the non-European markets, and we in Washington will be glad to assist the individual American manufacturer in the solution of these problems.

Slip, Friction and Stretch Tests for Leather Belting

By L. C. Morrow
Managing Editor, *American Machinist*

How the slip test is performed—Measuring stretch—Determination of coefficient of friction—Example of an overloaded belt running without tension on the slack side

LEATHER belts, like all products used to produce or transmit power, require certain tests, to show that their quality is being maintained in manufacture, and to point out opportunities for improvement. This article tells how several of the tests are carried out in the plant of J. E. Rhoads & Sons, Philadelphia.

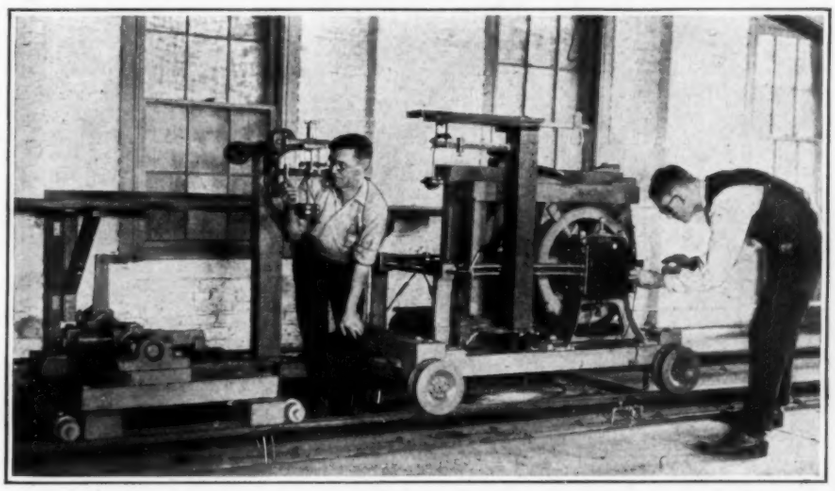


Fig. 1—Power slip testing machine with observers ready to take readings

A flat belt will carry an increasing load with slight slip, the slip increasing with the load. Not all belts will carry the same load with a reasonable amount of slippage, because the quality of hides and the methods of turning the hides into belts differ. Hence the value of the slip test as an aid in keeping the product uniform.

Slip testing consists in measuring the slip of a belt of given length, running under a known tension, transmitting a known horsepower. In using the machine shown in Figs. 1, 2 and 3, the belt is put on, tension regulated, and center distance recorded. The belt is then run, the prony brake set for a predetermined horsepower and the reading of r.p.m. and slip taken. To make the test more complete the operation is repeated for various horsepowers.

The slip testing machine consists of a line, counter or jackshaft for driving the belt; a prony brake and scale for applying and measuring the load; a support and scale for maintaining and measuring the tension; and a slip meter.

On the machine shown the belt is driven from a floor countershaft, the prime mover being an electric motor. Fig. 2 shows the countershaft and the belt under test. The prony brake is mounted on a platform carried by wheels with ball bearings, the whole resting on leveled rails. On account of the use of ball bearings, the effect of friction between brake carrier and its support is negligible. The brake carrier is attached to the tension block by a wire cable connected to crank

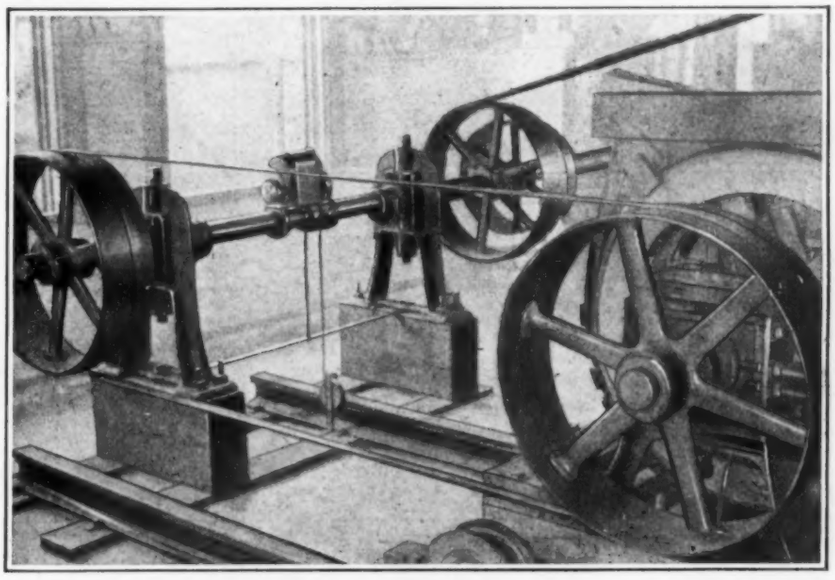


Fig. 2—Flat belt in place on pulleys of testing machine and countershaft (Note magneto on countershaft)

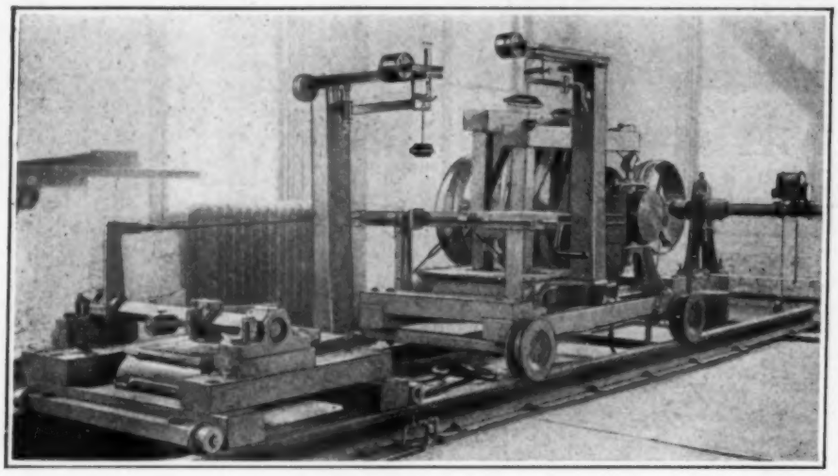
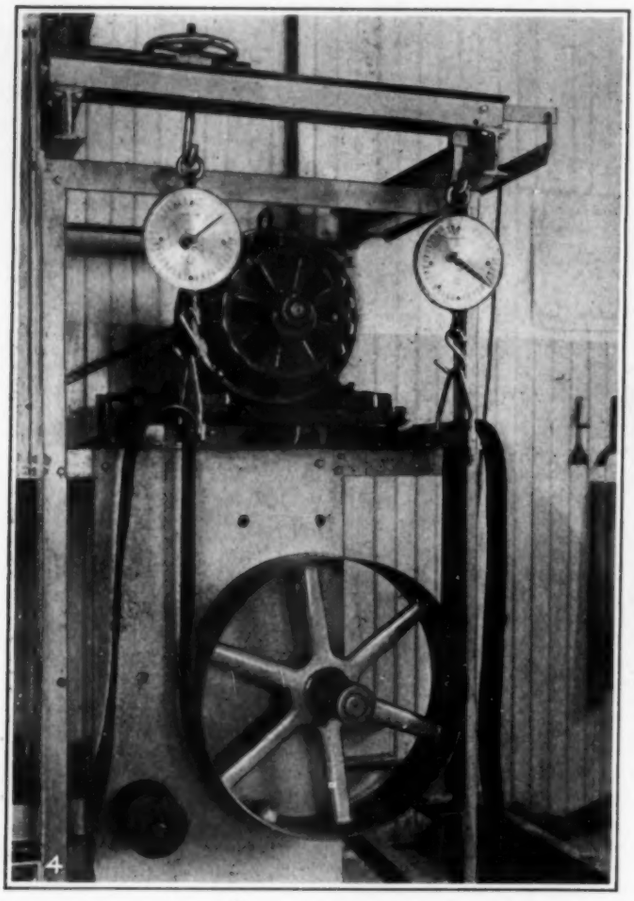


Fig. 3—Slip-testing machine complete

levers that bear on the platform of the tension scale.

There are two parts to the slip meter, a vacuum tube, mounted on a disk that revolves with the driven pulley and a high-tension magneto, mounted on the driving shaft (countershaft previously referred to), and arranged to deliver one spark per revolution of the driving shaft to the vacuum tube. The magneto may be seen in Figs. 2 and 3 and the disk supporting the tube in Figs. 1 and 3. Since the ratio of driving and driven pulleys is 1 to 1, there will be a flash in the tube for each revolution of the driving pulley if there is no slippage, and the tube will appear to be always in the same spot. When the belt slips, the driven pulley, and the disk which carries the tube, will not travel as rapidly as the driver, and the vacuum tube, the position of which is indicated by the flash, will appear to travel in a circle in a direction of rotation opposite to that of the disk. The number of apparent revolutions of



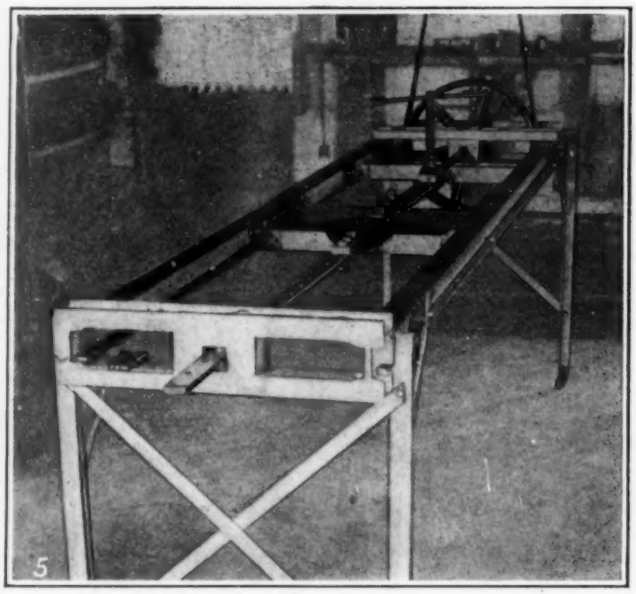
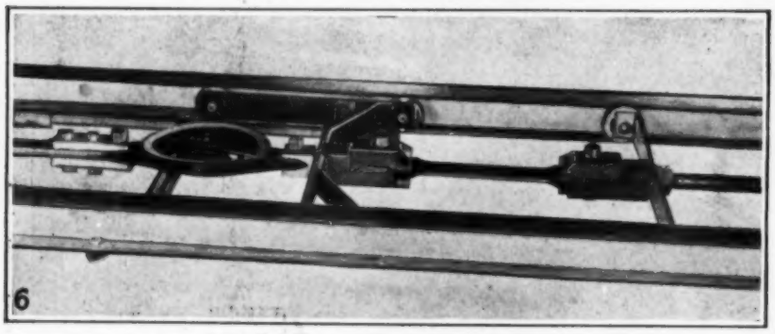


Fig. 4—Apparatus for testing coefficient of friction of belt on pulley. Fig. 5—Machine for measuring stretch and tensile strength of strips, with 3,000-lb. dynamometer in place



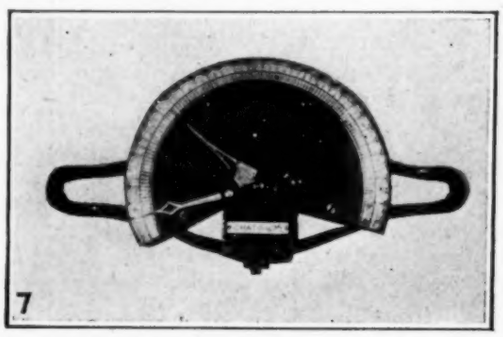


Fig. 6—Close view of the machine shown in Fig. 5. Fig. 7—3,000-lb. dynamometer

the tube, compared to the actual revolutions of the driving pulley, will indicate the percentage of slip. For example, if, while the driver revolved 990 times, the tube apparently revolved 10 times, the slippage would be 1 per cent. By changing the pulleys on countershaft and testing machine, slip tests may be taken for ratios other than 1 to 1. The magneto must be arranged to deliver a spark to the tube at frequencies proportional to the different ratios.

In another important test, carried out on the apparatus shown in Fig. 4, the coefficient of friction between belt and pulley is determined. A frame work of angle iron supports the pulley driving mechanism and two spring balances. The drive is from the motor shown through friction disks, an automobile transmission and a worm gear to the pulley, which is 24 in. in diameter. In this way a powerful drive, capable of a wide range of speeds, is obtained.

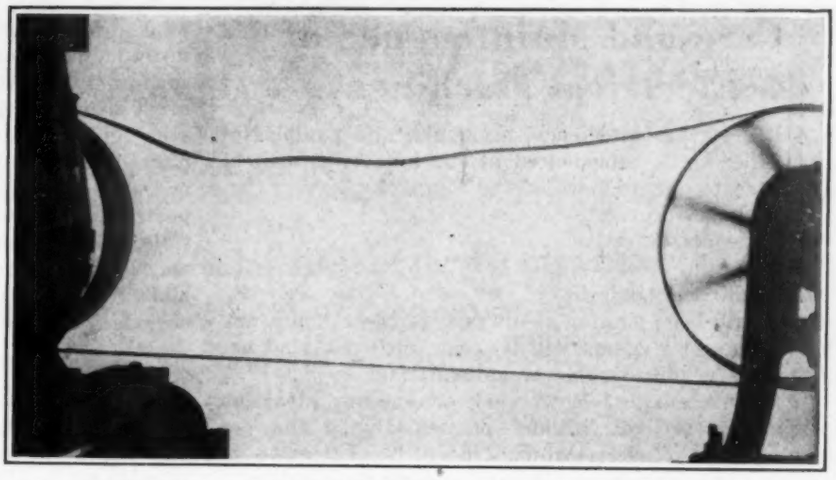


Fig. 8—2-in. belt running at 2,500 ft. per minute, showing that there is no tension in the slack side when carrying a heavy overload

The belt is attached to two clamps which are hooked to the spring balances. The balances are then set at equal loads and the pulley revolved. The coefficient of friction is calculated from the formula

$$\frac{T_1}{T_2} T_1 = e^{fa}$$

where T_1 = Net tension of the tight side of the belt in lb.
T_2 = Net tension of the slack side in lb.
e = base of the Napierian system of logarithms = 2.72
f = coefficient of friction
and a = length of belt in contact with pulley, expressed in radians.

In the cast-iron plate that supports the pulley are five holes into which the shaft of the idler pulley shown may be inserted. By means of the idler the arc of contact is varied.

In Fig. 5 is shown the machine used for measuring the tensile strength and amount of stretch of strips, using a 3,000-lb. dynamometer. The strips are held by clamps, as shown in Fig. 6, and power is applied by means of a screw of fine pitch. Connected between one of the clamps and the adjustable bar, which is secured by a pin to the frame work, is the dynamometer, shown in Fig. 7. As the belt stretches, the pointer on the dynamometer moves and the reading at the breaking point must be obtained by the observer.

There is little use in describing the testing of belts by running them to destruction. In making such tests it must be borne in mind that the conditions under which the belts are run must be positive, and should conform as closely as possible to the conditions under which the belts would be used. Comparatively simple methods of applying measured loads and of weighing tension may be employed. Periodic observation is required to insure constancy of the conditions of the test and truthful recording of the time of break-down.

One example of the value of the testing laboratory referred to is the test, pictured in Fig. 8, to determine the power of a small flat belt, and to show that there is apparently no tension on the slack side when it carries a heavy overload. The photograph itself is remarkable, as it was taken while the belt was running at a speed of 2,500 ft. per min. and shows that the undulations of the slack side were very nearly uniform. The belt was a single tannate, 2 in. wide, pulling 29 hp., which is 275 per cent of its rated load of 10½ hp. under favorable conditions. Under unfavorable conditions the horsepower would be reduced to 8½ or 9 and the overload that it could pull would probably be reduced somewhat. With no tension on the slack side, practically all of the tension exerted on the pulleys and bearings is transformed into the useful work of transmitting power.

The designer of today wants to select belts to handle what is considered the peak load plus the unexpected overload, and therein lies the value of the belt testing laboratories because they have made it possible for him to specify, without guessing, the sizes required.

Accidents at Metallurgical Plants

Statistical data compiled by the Department of the Interior, through the Bureau of Mines, indicate that the larger metallurgical works in the United States enjoy an advantage over the smaller plants in overcoming the accident hazards to which workers in metallurgical industries are exposed. The resources back of an industrial enterprise necessarily determine the expenditures that may be made for accident prevention work and for other purposes, the Bureau of Mines points out. To the extent that the number of men employed indicates a plant's resources and equipment for safety work, figures based on the operators' reports for 1922 show that mills and smelters employing 200 or more men each suffered fewer accidents for any given number of employees than did smaller plants, those employing less than 200 men each. Accidents were most frequent where only 1 to 25 men were employed. Mills employing 300 or more men each had an accident rate lower than that for any other group; next in order were mills employing 50 to 99 men; the third lowest rate was for mills employing 200 to 299 men each.

Detailed statistics regarding accidents at metallurgical works in the United States are given in Technical Paper 350, which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

Care and Maintenance of Electrical Machinery

MOST of the inefficiency, accidents, and troubles of other kinds experienced in our industries may be attributed to one or more of the four "M's."

1. Methods incorrect
2. Materials defective
3. Man-failure, or
4. Machine breakdown

Much has been written about each of these items, and the end is not yet, nor will it come until mankind has undergone a considerable transformation.

In the present article we shall confine our attention to machine breakdown, and particularly to the one great cause of electrical-machinery breakdown — the lack of a proper system of care and maintenance.

A marked feature of electrical machinery is its reliability in service, provided the design is correct and good workmanship and material have been used in its manufacture. In fact we cannot recall, off-hand, any general type of machinery that will give equal service with so little care. The first obstacle is encountered by the ease with which so many users of electrical machinery change the last four words of the preceding sentence to read "with no care."

Treating Machinery Intelligently and Getting Results

The owner who expects standard performance or maximum returns from a span of horses would serve himself and his animals very ill if he failed to groom them, and to provide sanitary and comfortable stables and proper grain and fodder. The soundness of this principle is universally admitted in connection with horses, but the fact that the same fundamental idea applies equally well to inanimate objects does not appear to be so well understood. The owner of electrical machinery, for example, handicaps himself by failing to give it a certain amount of daily care. A half an hour daily is, perhaps, the minimum time required to care for the horses properly. Many owners of electrical machinery have a number of units, any one of which costs as much as the horses and performs a service of equal or greater importance. It is not unreasonable to ask him to spend half an hour or so daily in caring for and maintaining this electrical equipment.

We cannot discuss here all the causes of trouble in electrical apparatus, but we want to call attention prominently to three factors which are especially likely to lead to breakdown. They are (1) vibration (2) moisture and (3) dirt. All of these are easily within the control of the owner or his representatives. It is well known that vibration is detrimental to machinery in general, and it is especially so to electrical apparatus. Solid supports for such apparatus are important, yet it is not uncommon to see motors loose on their foundations, or perhaps secured to the ceiling and subjected to serious vibration in consequence of the operation of other machinery on the floor above—vibration which could probably be materially reduced by providing one or two good solid shores. In addition to the chance of deterioration through the fatigue of the parts subjected to the vibration, we have to think also of the likelihood of displacements and of needlessly rapid wear. Moreover, it does not take much shifting to throw a motor out of line and if the installation is of such a nature that good alignment is important, a great deal of trouble may be produced in this way. And even an apparently trifling internal displacement in a piece of electrical machinery may cause a breakdown on account of the small clearances between the moving parts and between parts that are at different potentials. Daily inspections are exceedingly helpful in the way of discovering all these things and making it possible to take remedial steps at trifling cost before a serious interruption of service occurs.

Moisture and Electrical Machinery Breakdowns

It is not necessary that a machine to be affected by moisture should be exposed to the weather. The vapor that is present in air, having a relatively high humidity, will condense on the apparatus, and even ordinary damp air may affect the insulation. If the moisture of the air contains even the smallest trace of acid the insulation is almost immediately attacked, and a breakdown is not far away.

Dirt is a specially serious trouble-maker,—not only on account of the various ways in which it can affect apparatus, but also because it is present everywhere and at all times, and an injurious amount of it may accumulate within a single day. It may clog up the ventilating ducts, causing local overheating and burnouts; it absorbs moisture and other things which cause rapid deterioration of the insulating materials; and it may act as a conductor, causing a short circuit and giving rise to more trouble.

Systematic Care

None of these causes need be a source of annoyance if the owner provides for a reasonable amount of systematic care. Various interpretations and limitations may be assigned to our meaning here. For example, it is obvious that a motor so installed as to be subjected to extreme vibration, and located in a damp room where there is considerable dust or dirt, will require far more frequent attention than one more favorably located. It follows, then, that an infrequent service-inspection, even though it may be of the utmost excellence in itself, and whether it is supplied by an insurance carrier or otherwise, may not prove sufficient for all the electrical equipment in a given plant. In one type of plant some motors require daily inspection, while others perhaps need it only once a week or once a month; but in another plant, near by, it may be highly important to give daily attention to 80 or 90 per cent of the electrical equipment. Therefore, it is evident that it is impracticable to formulate rules or suggestions concerning the character and frequency of inspections, that will be universally applicable. Every plant presents an individual problem in this respect, and must be handled accordingly.

It is true that any kind of inspection service should disclose the faults that exist at the time of inspection, and if these are promptly corrected, trouble may be avoided for the moment. Faults develop between inspection dates, however, and if the inspections are too far apart some defect may arise which, though not, sufficiently serious to cause immediate breakdown, will result in a measurable amount of general deterioration, so that the unit will be less able to withstand another long period of comparative inattention.

From the *Travelers Standard*.

Filling the Ranks of Machinists

By John C. Spence
Works Manager, Machine Division, Norton Company

Southern Europeans are replacing men of the Nordic races in machine shops—Apprenticeship problem must be fairly faced—Real wages and a real education for the boy

OUR SHOPS are gradually being filled by men of southern or eastern European blood. The boys of northern European blood are not taking to mechanical pursuits as they did in the past. Of course there are communities that are exceptions to this. It is probably still true that in towns where the shop draws from the farm or small community, the majority of beginners are of northern European blood, but in the larger centers we find Italians, Poles, Russians, Hebrews, Syrians, Greeks, etc. Our foundries have already shown a decided change in this direction. The machine shops are quickly following.

Why has the change come about and why do we care who mans our shops? If you will carefully investigate the real progress of the human race, you will find that there has been more advancement since the advent of the mechanical age than in all of preceding history. Who have been the peoples responsible for this? With very few exceptions, the great inventors and scientists of the world were either born in, or were descended from the natives of the British Isles, Norway, Sweden, Denmark, Holland, Germany, or France. This is not said in any spirit of criticism, but is merely stated as a fact.

The Teuton and the Gaul feel towards each other today just exactly as did their ancestors when they were clothed in animal skins and fought with spear and shield and each believes the other still has the ancient traits. Most outside witnesses who have read history, both ancient and recent, agree with them. Furthermore, the real trouble in Europe has for its foundation these very traits, together with a certainty of their perpetuation.

Inventors or Copyists?

So I believe it to be fair to assume that if our shops are peopled with descendants of the countries I have named, we will continue to produce inventions for the rapid advancement of the world. Also, I believe that if our shops have to depend on men whose ancestors came from Southern and Eastern Europe and Asia, we will cease to lead the world and will become copyists, with all the results of that state of affairs.

We in New England, who have lived through the fourth quarter of the last century, have seen the cycle of nationality changes in the cotton mills. The first operators were English and Scotch, principally English. These were superseded by the Irish. They gave way to the French Canadians. The Poles pushed these out. The Portuguese came next and now it remains to be seen whether the incoming Greeks will oust the Portuguese.

In an industry composed principally of operators, it does not make so much difference as to the inventive ability or mechanical sense of the workers so that it is all very well to fill our cotton mills and our automobile plants with non-inventive people, but it seems to me there is a danger in carrying this plan into our machine tool shops. You believe rightly that you build the "master tools of industry" and that on your industry more than on any other, our country and the world depends for mechanical advancement.

Machine Shops Are Interesting Places

If I am right so far we should, as an association, begin to find out how to remedy this condition. We can, perhaps, understand that foundry work is not attractive to boys raised in homes, schools and surroundings made possible by our standard of living, but the machine shop, while considered dirty by some, is certainly interesting to boys mechanically inclined and offers without question, wider fields for future continuous employment than does any other trade.

What then makes it so difficult to obtain the right kind of boy for the shops of this association? There are several reasons and they are all within our power to remedy, but unfortunately they require co-operation on the part of all of us and that is the one and only reason we have not done it before.

First: We have, in the main, given up the definite organized training of apprentices. We prefer to let somebody else do the donkey work while we grab the results of their labor.

Second: Those who have made sporadic and spasmodic attempts at apprentice systems have failed because they neither paid the boys enough nor did they lay out and maintain a course that would give the boys real machinist experience. Frankly, the apprentice courses of many firms between 1890 and 1920 were operated, in my opinion, for the profit of the employer and the exploitation of the boy. There are great exceptions to this and I wish here to cite as examples of what we all should do, the Brown & Sharpe Company and the General Electric Company. Many others who started apprentice systems with every good intention failed because there was no one person in the plant with the time or the desire or the competence to carry it through.

Third: The machinist trade has been underpaid in general when we consider how much a real machinist knows and does compared to some other callings. The rate of wages, in turn, has been low, principally because we have not charged enough for our product.

An address before the National Machine Tool Builders' Association at Worcester, March 18.

An examination of selling prices will show that in most cases the roughest kind of farm tool sells at a higher price per pound than the fine machine you build. The experience of older friends and relatives of the boys we should have has decided the boys to go into some other line. To help him, modern organization of industry has created thousands of white collar jobs that look much more attractive to our high school boy than do the production jobs. The 1920 census shows that our population has doubled since 1880, the people engaged in railroading, mining and manufacturing, three times as many, but in these three industries, we now have seventeen times the number of clerks we had in 1880, and this does not take into account those engaged in direct sales work. Possibly here is a slight clue to the cause of the high cost of doing business. Associations like this do well in attempting to standardize cost systems, but it would be a great thing for our country if we could find a satisfactory way to make more chips in a given shop with a given total number of employees.

In addition to the competition set up by the white collar jobs, the boy has watched the meteoric rise of wages in such callings as the building trades. It is of little avail to tell him that perhaps the yearly wages are no more, or are even less. He is attracted by the high hourly wages and by a short working day. We, who believe we understand, realize that when one trade is overpaid, somebody else must be underpaid and that there is not enough money to pay everybody on a comparative basis with the hod carrier who may be getting ninety cents an hour. The boy doesn't understand, and very likely his advisers do not understand. They do not realize that if we are all unionized on the principles now practiced by the A. F. of L. there would be an end to either high wages or to work. One way to end unionism, socialism, or communism is for everybody to join. The recovery comes after a more or less protracted period of economic nausea which is good for the patient if he doesn't die, but which is not at all necessary for any people to go through if the greatest good for the greatest number is desired.

Who Will Design Our Machines?

However, things are as they are and there are some who believe they should be given organized attention. Our country is probably definitely committed to a policy of restricted immigration. This already has resulted in a shortage of unskilled labor, a condition that will become more acute. We can remedy it by the use of machinery for every job now done by hand wherever a machine can be used. This is a fine thought, but who will design the machines? Granting that the bright fellows left over from the last century can design them, who will build and operate? You remember how you were put to it to get one more good turret lathe operator in late 1919 and 1920? Well, that was a cinch compared with what is coming if we live up to what I believe our country will try to do under the new self-imposed conditions. The training of first class mechanics is the answer and this training will have to be more than simply of the hands. Each of us will have to spend money in giving the boys a balanced mental training. I will live to see such associations as this agree on uniform apprenticeship, uniform apprentice wages (at least in districts) and so high that they will frankly be considered partially as subsidies on the future, and an honorable understanding that members will not hire away an apprentice without the consent of the employer to whom he is pledged, also an exchange of apprentices for experience in those branches where one shop cannot give the experience.

In addition to this phase of our business, there are other points that should be considered. We have quite successfully, through co-operation, solved the safety question and the compensation question, while we have had solved for us the hours of labor of at least women and minors. There are questions that other people are beginning to look into and yet we should be the most competent to solve them because we are in position to know both sides of the question. For instance, regardless of what anybody says to the contrary, the general subject of piece work has never been solved. This subject is as worthy of united study as is the elimination of waste. The unemployment question must be faced, especially for those who are skilled. The solution will eventually be recognized as a real move towards the elimination of economic waste for we all know the cost of replacing men skilled in our particular work.

Some firms are already trying out plans along this line. One of them guarantees a certain number of weeks' work of a certain minimum number of hours per week after the employee has worked for the firm for a period of five years.

Reserve Funds for Veterans

A recent investigation by a Massachusetts Industrial Association would indicate that this would require a reserve fund of about two weeks' payroll. The idea includes the use of these veteran employees on any kind of work connected with the plant and not necessarily at their own particular trade. The difference between the trade rate and the rate of the temporary job is paid from the reserve fund. The reserve fund creates confidence in the workers' minds and keeps the competent man, who usually can get another job, from leaving the firm that will, after the slump, expect to need him.

Then there is the question of old age or inability to work. Some firms, fearing the results of pension systems, are quietly attempting to handle this problem of taking care of their older workers in a way that considers each case according to circumstances. We all should begin to look at unemployment and old age care as two of the duties that our semi-socialistic tendencies may impose on industry. Possibly the pendulum will swing the other way, but regardless of that, these two things are fine for any firm to do that can afford them and we all should be thinking of them as a means for making our particular trade attractive to intelligent workers. There are, of course, many other contacts between employer and employee that can be maintained and improved upon, such as the relationship of foreman to man, employment and discharge, sanitation and physical care.

Furthermore, I believe in frank propaganda. If this is such a force for evil, why won't it accomplish good? The Christian religion depends for its very existence on propaganda. We should keep at it. A solution of the subjects mentioned would go far to keep our industry on a high plane and attractive to intelligent men. We can do these things without being socialistic to any harmful extent. We need not have industrial democracy or any of the well meant but impractical plans reccently advocated, but we can try to remember that those who are strong in brains and earning power will make better leaders than will the agitator.

How You Can Find Lost Time

By L. M. Francis

Lost time of labor and tools—Investigation of causes and methods of correction — Data required and use of control chart — Job completion time notification

IT IS generally agreed, I believe, that most of the difficulties met with in high production manufacturing, granted conditions as a whole are favorable, are due to faulty planning. This is a broad statement and assumes that planning, which is nothing more nor less than application of good judgment, starts even before business is accepted, in determining whether it can be successfully handled at the price figured.

Of all these difficulties, the loss in operating time is probably one of the greatest factors, from a standpoint of both finishing work on time, and finishing it within the estimated cost. Such losses in time almost always occur unexpectedly, and from causes hard to foresee and, since this is the case, the planning in this connection must be primarily along a line that will as far as possible remove general causes and locate specific causes before the results of the losses occasioned have grown to appreciable proportions.

Lost time as concerning machines and operators may be divided into two main factors, lost man time and lost machine time. Lost man time is that time taken by an operator in doing certain specified work, which is in excess of the time in which it has been found possible to handle the work efficiently. Lost machine time includes regular working hours during which machines are not running, for whatever cause. This does

DAILY REPORT LOST PREMIUM HOURS

MODEL ○ DATE

DEPT	PIECE No.	OPERATION No.	OPERATORS No.	ELAPSED HOURS	STANDARD HOURS	LOST HOURS	REMARKS

Fig. 1—Report form for lost man hours

not include machines which are installed for intermittent operation only, but is meant to take in the regular run of machine equipment, purchased for the purpose of continuous use in turning out the regular product of the plant. With such equipment, non-operative time creates an expense which must be borne somewhere and finally reduces profits.

There is no doubt that many manufacturers are continually standing a loss, due to the conditions mentioned above. They may have a good system of estimating, with an accurate basis for detailed costs in the way of piece prices or standard times, may apparently make ample allowances, figure and apply overhead accurately and yet, when an order is shipped, find profits less than planned on.

An investigation of the matter may bring out the fact that a machine broke down, stock was intermittent in supply, a new man handled the work, etc. These excuses seem reasonable as applying to the order being considered, and the matter is passed over until the next order has to be investigated.

In order to get at the bottom of the matter, it is necessary to know just what is going on. A report indicating what men have not earned expected wages and showing how much excess time has been used

DAILY REPORT LOST MACHINE HOURS

MODEL ○ DATE

DEPT	PIECE No.	DESCRIPTION	MACH. No.	MACHINE NAME	LOST HOURS CAUSED BY			
					Tool Trouble	Mach. Repairs	No Stock	No Operator

Fig. 2—Report form for lost machine hours

should be obtained daily. If men are paid on day work basis, it will probably be necessary to estimate allowable times, or get them from past performances that are known to be good. If standard times or piece prices are used, then the basis for this report is at hand.

Another report should also be obtained, showing all machines inoperative for any reason, and the time. There are four reasons for lost machine hours, which will generally cover causes for machines being shut down. They are tool trouble, machine repairs, lack of material, and absent operator. The items can be chosen however, to suit specific conditions. Specimen forms for the reports mentioned are shown in Figs. 1 and 2, and they can be made out by the departmental executives.

With these reports at hand, an analysis will begin to show something. If a certain operator continues to fall down, it is apparent that he is either working at the wrong occupation, has not been sufficiently instructed or that he is not attempting to exert himself. Where several operators who are known to be good men fall down, it may be found that standard times or prices need investigation, delays of one kind or another may be found prevalent, or materials worked on may be difficult to handle due to being off grade.

In the case of machine lost time, if there is excessive trouble with tools the matter can very probably be brought back to the persons designing, making and repairing tools, or to the conditions under which they are working. If there are too many machines delayed for repairs, it may be found that certain equipment is worn out, and simply will not operate for any extended period without repairs. This condition warrants replacements. In addition, the department han-

dling machine repairs may be short handed, causing delays in getting to jobs, or may not be competently manned or supervised. If lack of material is causing machines to shut down periodically, then there is something the matter with schedules or the purchasing or follow up departments. If material delays in going from one operation to another, it may be due to lack of productive capacity at some point, possibly to not having enough in process, or even to transportation methods.

These are some of the things which may be arrived at as basic causes for the difficulties being considered. An investigation, using information from the reports mentioned, will show up such as these or others. It is not usually found impossible to correct an adverse condition, when it is possible to point clearly to where the responsibility lies.

The method used in one large motor plant to investigate these losses, as finally developed, involved the plotting of each job, against its machine number, on a large sheet having divisions for each working hour of the week. In Fig. 3 is shown a section of such a sheet, the machine numbers being listed vertically.

Fig. 3—Section of control chart record

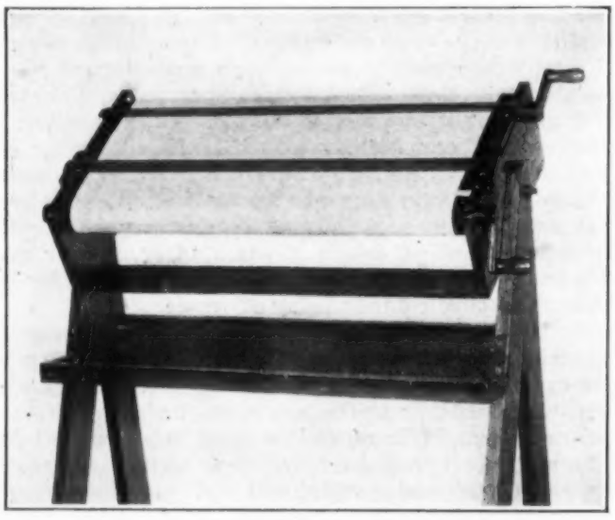


Fig. 4—Control chart stand

These sheets were several feet long in some departments, and a special stand was built on which to operate them conveniently. The illustration of this stand, Fig. 4, plainly shows the arrangement for quickly extending the job lines against any machine.

Without going into details, the following paragraphs will explain fairly clearly, the use of this control board. It is to be understood that in this plant, a premium system of payment was used, and all regular production operations were supposed to have allowed times set. Lost premium time was considered as the time taken in excess of allowed time set for the operation.

Each premium job, when assigned, had the total allowed time figured on the ticket, and this time was immediately plotted on the control board, using a blue line and covering as many spaces across the sheet as demanded by the time allowed.

The actual finishing time on each job was indicated by a short vertical mark, and the next job worked started from that point, if following immediately on same machine. The number of spaces which two premium lines overlapped, indicated the number of hours gained on the job finished. A space between two premium job lines indicated the number of hours lost on the work finished.

If a machine became idle for any reason, a small cross mark indicated the time of ceasing work. This was done at the time the operator changed his time for some other assignment. The reason for the machine being idle was ordinarily indicated in code at the point involved on the sheet. "NS" showed no stock as the cause, "NO", no operator, and numbers were used for tool trouble and machine repairs, respectively.

If an operator was assigned to a day work job, a black line was started on the sheet at the time of assignment, and when the job was completed, this line was extended to cover the number of hours elapsed.

In case of temporary delay, where the operator would continue on the same job, a red line parallel to the blue assignment line, covered the number of hours involved in delay and, when work was started again, the blue line was continued for the same number of spaces, to indicate the limit of allowed finishing time.

Assignment lines were carried over from one week to the next on unfinished jobs, being simply continued

as required on the succeeding sheet of the chart.

The immediate benefit from this control board was gained by reports which were given to foremen and sub-foremen every two or three hours, showing assignments that were to be finished within the next few hours, if no lost time entered. These reports involved the use of judgment on the part of the control board operator, in reporting jobs far enough ahead so that the investigation that followed each report would at least be in time to remedy any serious difficulties in the way of successful completion of the work. The form used for this notification to foremen is shown in Fig. 5. The control board operator also spent what time he could investigating progress of work. It can be readily understood what assistance this procedure was to the supervising force, in allowing them to more or less disregard operations in progress, except as specific items requiring attention were brought to them.

As to results, the following is illustrative. In one department of the plant the lost premium hours per man were reduced from 9.5 hours, for a two weeks' period in November, to 3.4 hours for a two weeks' period the following February. This department employed a minimum of approximately 175 men, so that the difference amounted to a total saving in time of 1067.5 hours in two weeks for the last period as against the first. At a rate of 75 cents per hr. such a saving is certainly worth making. Results in other departments were equally good.

The value of the added production obtained is hard to figure, but shows up in lowered costs and smoother operation. It goes without saying that the follow-up

NOTIFICATION TO FOREMEN
Jobs Due for Completion

Dept. 6 — Foreman Jones. — TIME ISSUED 1:30 P.M. — TIME JOB SHOULD FINISH — DATE 1/21/24

Machine No.	Man's No.	Piece No.	8	9	10	11	1	2	3	4	5	Day Night	REMARKS
2036	120	54670							X				
708	164	14620						X					
1847	132	53621							X				
2042	129	54672								X			
1246	87	60240						X					

Fig. 5—Form for notification of job completion time

work done also has a considerable effect in inducing men already earning premium money to earn more, thus again reducing production costs. This is indicated by the fact that the efficiency ratio of the department in question, rose in the period considered from 107 to 129. These numbers, I might state, are arbitrary figures for comparative purposes, and are computed by a method of figuring efficiency which is affected primarily by the number of premium hours gained and the number of day work hours.

Summary reports, taken from the control sheet showing lost hours, etc., went periodically to plant executives, allowing them to note exact conditions quickly. In large departments it took one man's time to operate the control board. In smaller departments the duties could be included with those of the clerk handling the time tickets.

Whether the matter is gone into on a small scale, by simply requiring departmental reports on losses, or in a more extended manner, I believe it is worth while for every manufacturer to satisfy himself as to whether or not he is paying for a lot of lost hours, thereby reducing the efficiency of his plant, and if he is, to get to the bottom of the matter and find the causes.

Mobilizing Industry—Discussion

BY FRANK C. HUDSON

The discussion on mobilizing industry by E. C. Oliver, on page 389, Vol. 60, of the *American Machinist*, deserves the most careful consideration by those whose duty it is to prevent being "surprised" and also to defend the country should necessity arise. Mr. Oliver points out very clearly some of the difficulties encountered in 1917-18, both as to needlessly severe tolerances and the lack of knowledge concerning the best methods to be used.

There is, however, another point which needs to be carefully considered before we establish that "experimental station in the form of a small factory" for the manufacture of such things as shells, rifles, etc. One of the difficulties in 1917-18 was that many of the things needed were poorly designed and when they were finally approved they were unnecessarily difficult to manufacture.

This was partly due to needlessly close tolerances and also to the fact that the designers know nothing of manufacturing. Pieces were designed without regard to manufacturing difficulties because those who designed them did not appreciate that it was much more difficult to work an odd shape out of metal than to draw it on paper. Nearly every gun designer wants to make everything of steel forgings, whether it is the receiver, or the band which holds the barrel on the stock.

Before we start that experimental factory let us call in production men to study the designs and suggest ways in which they can be simplified for ease in manufacturing. The production engineer can be of far greater service in pointing out difficulties in manufacture, and in assisting in the simplification of designs and specifications, than in devising methods for manufacturing unnecessarily difficult pieces.

The Army engineer is responsible for the proper functioning of a piece and this must always be the first consideration. But there are many cases where the design or specifications can be greatly simplified without in any way affecting the proper functioning of the piece.

The bayonet is a good illustration. Bayonets were rejected for a variation of 0.002 in. in thickness of blade. In reality the blade need not be machined at all. It can be forged, ground, tempered and polished without going near a milling machine so far as its functioning is concerned. Any necessary shape of blood groove can be ground instead of milled, and the exact thickness is unimportant. Drop forgings come very uniform, and any variation in the thickness or weight is negligible. The blade fits nothing but the scabbard or the victim, and close tolerances are unnecessary in either case.

I am heartily in favor of Mr. Oliver's proposal. The delays of 1917-18 should never occur again. But I am convinced that it is even more important to have work so designed that it can be easily machined in the average shop, and to have tolerances that are workable, rather than to have men trained to do work that is unnecessarily difficult.

If good production engineers are called into consultation, and allowed to suggest simplification before the designs are finally approved, the average shop can handle the work much more easily than will otherwise be possible. Let us have the experimental plant by all

means, but let us first simplify the munitions to be built, both as to design and tolerances, always remembering of course, that the ordnance engineer will and must insist on the proper functioning of each piece as the first consideration.

Operating Expenses of Salesmen's Cars

AT THE request of a subscriber we have just made a survey to find out how the problem of meeting the operation and maintenance costs of cars used by salesmen is met by various companies.

The first question to be answered is whether the company or the salesman should own the car. If the company owns the car it is natural to assume that it pays all expenses. If the salesman owns the car there are various ways of reimbursing him for the cost of operation and maintenance and the question is which one to choose.

Two-thirds of the companies that replied to our request for information own the salesmen's cars. A survey conducted by *Electrical World* recently shows that all the companies replying to its questionnaire owned the cars. Evidently this method is far more popular than to have the salesmen provide their own transportation.

Various restrictions are enforced by the different companies. Several of them do not permit their cars to be used on Sundays or holidays. One company permits no other person to ride in the car with the salesman. Another company limits passengers to employees. Still another permits its salesmen to authorize minor repairs up to an amount of $25. If they exceed that figure the district manager must be consulted.

In some cases the salesman reports daily his mileage and any expenses incurred. In others a weekly report is required, while in still others the salesman needs to report only once a month.

When it comes to reimbursement of salesmen who own their own cars there is no uniformity of practice whatever. Some companies pay on a mileage basis, others on a flat daily rate and others on a weekly basis. In one case the salesman meets the operating expense but is allowed from $1 to $3 per sale, depending upon the locality in which he works.

The cost per mile as reported by the companies replying to the *American Machinist* letter varies from $0.05 to $0.12. The lower figure does not include depreciation or insurance. Daily allowances are from $2 to $3.50 depending largely on whether the car is operated in city or country districts. One company which allows $3 per day estimates that this figure will cover the depreciation on a Ford but not on a larger car.

Not very much information on car life was forthcoming. In one case, however, average life is from two to three years or 25,000 to 45,000 miles. In another case 60,000 miles is about the average life as based on experience with a fleet of nearly 200 cars of the same make.

Apparently there is still much to be learned about the operation of cars for salesmen. Perhaps the best thing to do is to develop a more or less standard system of cost accounting. In some cases such a system is already in effect. Where it is, the relation between running expenses and overhead on different types of cars is rather surprising in its variations.

Motor Shop Problems

Babbitt Bearings—Push Rod Guides

BY FRANK C. HUDSON

BABBITT bearings in connecting rods receive a lot of attention, and deservedly, because they are very vital to the success of a motor. Not only the quality of the babbitt but the way in which it is applied, are subjects for much discussion. Die cast bearings, meaning in this case those into which the babbitt is forced by a plunger or pressure otherwise applied, are very common and usually very satisfactory.

There is, however, a tendency to get away from this method and to cast the bearing under centrifugal pressure. The rod is clamped to a plate with the large end at the center, usually just inside a shield with a central hole. The rod is revolved quite rapidly and the babbitt is poured into the hole in the rod through the hole in the shield by means of a small ladle with a spout on one side. The whirling of the machine throws the babbitt against the tinned bore of the rod and is said to insure a more uniform metal, with less tendency to blow-holes and soft spots, than the usual die casting methods.

WHAT THE TESTS PROVED

In this connection it is of interest to record the result of a long series of experiments made some years ago by one of the engineers in a large automobile plant. The question of improving or hardening the babbitt by broaching was being discussed, the theory being that this was equivalent to peening as in the old babbitt-bearing days in large machinery. So it was decided to test the effect of broaching on the hardness of the metal.

Tests were made with the same type of machine as used by type founders in testing the hardness of type metal. The machine consists of a lever carrying a hardened knife edge and a weight on the outer end. The marks made by the knife edge indicate hardness and are comparative. The tests showed no apprceiable difference in hardness between the various methods of casting, indicating that while peening and broaching might seat the babbitt more firmly in the rod, neither method affected the hardness of the metal.

One of the changes in motor construction to be seen on a few motors, is the making of the valve stem push rod guides separate from the cylinder block.

The older method was to drill and ream the holes for the push rods or valve lifters in the cylinder block casting. Any error here meant throwing away the cylinder block or bushing the hole. Furthermore it meant taking out the cam shaft to put in a new push rod.

The new method groups four or six push rods in one casting and bolts this casting to the cylinder block in the proper place, by two or more bolts. The whole group can be taken off by removing the valve cover and any replacements made in a few minutes.

Furthermore, these guide blocks can be milled and drilled in easily handled fixtures at a rapid rate, there is less spoilage and the total cost ought to be less than before when all things are considered. It is one of the many cases where we can simplify construction by making an extra piece and bolting it on instead of trying to make it all in one casting.

Ideas from Practical Men

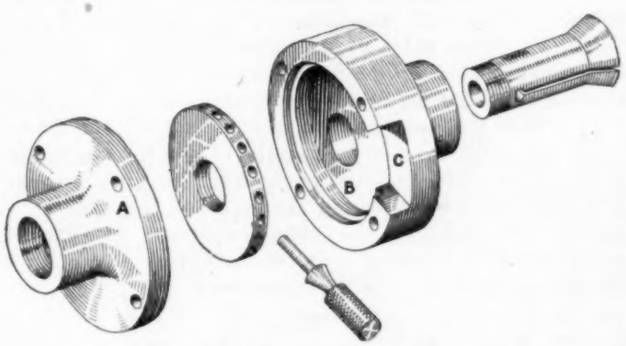
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

A Collet Chuck for the Engine Lathe

BY W. T. CLAYTOR, JR.

The sketch shows a collet chuck for a lathe that had no hole through the spindle, necessitating a substitute for the draw bar, to be operated from the front end. Except for the collet, the chuck was made of plain castings already on hand, the two principal castings being gear blanks.

One of the blanks was bored and threaded to go on the spindle nose as at *A*, and was faced off in place. The other blank was chucked by the hub, faced and recessed as shown at *B*, to abut against the face of *A*, and was attached thereto by a circle of ⅜-in. cap-bolts. The face of *A* was shouldered slightly at the proper



Novel way of making a draw-in chuck

diameter to enter the recess in *B*, in which it was a tight fit, and served to center the latter when assembling. Fitted to turn freely in the chamber formed by the enclosed recess was a plain round nut, also of cast iron, with a series of holes in its periphery to take a small "tommy-bar."

After parts *A* and *B* were assembled the body formed by the combined parts was machined all over and polished. A hole to take the collet was then bored and the tapered portion thereof carefully fitted. A keyway was cut in the bore by means of a suitable cutter held in the boring bar; the lathe carriage being "pumped" back and forth by hand.

Having reached this stage, the body was disassembled and a portion of the shell cut away as at *C* to make the holes in the nut (which up to this time had not been put in place) accessible to the tommy-bar. The cut-away space in the shell was more than long enough to cover two holes in the periphery of the nut.

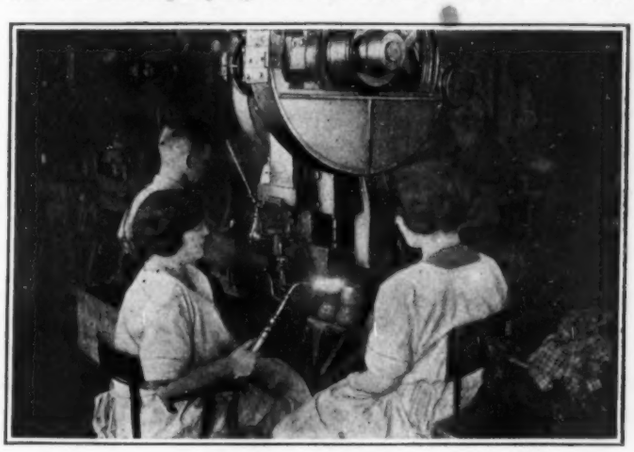
Assembling the parts with the nut in the chamber, the collet was put in the bore and the threads engaged with the nut, after which the latter was run up as far as was desirable by means of the bar, entered through the cut-away part of the shell. As the nut turned freely in the chamber this was not at all difficult to do, and unless the work was to be held more than ordinarily tight, the collet could be tightened or loosened by rotating the nut only the distance covered by the cut out.

Press Work Upon a Clutch Part

BY AMOS FERBER

In an article under the above title, published on page 302 of the *American Machinist*, there was described a series of operations in making and assembling sheet steel parts for a small clutch. One of the operations is the inward lancing of a small hole for the purpose of raising a burr or flange of metal around the hole of sufficient height to allow a substantial thread to be tapped in the shell. To turn up this flange without cracking the metal it is necessary to apply local heat.

To handle this job of heating and lancing, as if the heating were an unnecessary part of the sequence, requires "team-work" and skill to a considerable degree. The cut accompanying this article shows how it is done.



Local heating and lancing the shell

The press operator handles the shells as if they were cold, and there is always a heated shell ready to his hand as he throws the previous one aside. It is the duty of the operator to the right to see that a shell is in convenient position for him to grasp it, and of the operator in the middle to see that it is properly heated.

The heating medium is the oxy-acetylene flame, and upon the wielder of the torch rests the greatest responsibility; for the time available for applying the heat is limited to the time it takes the pressman to pick up a shell, place it on the horn die and trip the press—and she must not allow the flame to come in contact with the fingers of either operator as the shells are passed from one to the other.

Because of the intensity of the heat and the rapidity with which it is applied, the temperature of the shell, as a whole, is not raised appreciably.

Special Apparatus for Taper Threading

By W. O. Russell
Canonbury, London, England

The writer was recently called upon to execute an order for taper screw thread gages, including both Whitworth and Briggs standard taper pipe-thread gages. The available equipment was normally used for standard parallel screw plugs, and consisted of a special plug machine, together with the smaller tool and measuring devices associated with screw gage measurement. The machine was without a taper attachment, tapers being cut by setting over the tailstock in the conventional manner.

Since the plug gages to be made varied in length according to the nominal diameter, so that each size of plug required the resetting of the tailstock, an adjustable mandrel to serve as a taper setting piece was made as shown in Fig. 1. The body was of mild steel, carburized, and machined before hardening, so that only the hole and the solid end *L* were hard.

The hole was ground to size, and three hardened mandrels, 2½, 3½ and 4½ in. in length were made with a good tight sliding fit in the hole. A square recess was then cut at the smaller end of the body and so located that, when the faces *C* were squared up, the axial distance between them was exactly one inch. The taper was determined by the difference in diameters at *EF* and *GH*.

In use the taper setting piece was adjusted so that its over-all length was exactly the same as the gage being handled and, when set for length, a setscrew served to hold the mandrel fast in the body. The lathe was then set to cut a taper of ¾ in. per foot, as near as possible, and a cut was taken over the face of the setting piece. Finally, the tailstock was adjusted so that the difference in diameter between *EF* and *GH* was exactly $\frac{1}{16}$ in., giving a taper of ¾ in. per foot. The depths of the centers in all gages and in the ends of the setting piece were made uniform.

A setting piece for the screw cutting tools was also required and, since this also had to be of the same length as the gage being handled, it was embodied in the tapered setting piece described above. The 60-deg.

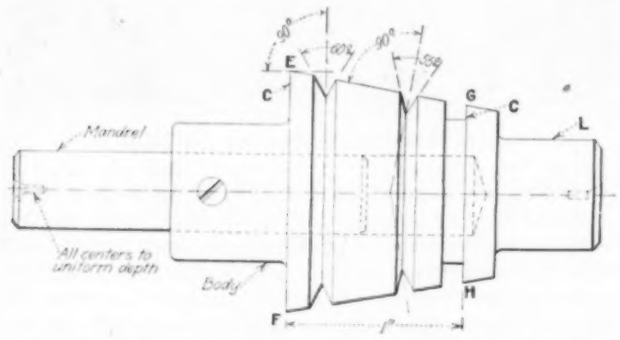


Fig. 1—Gage for setting tailstock and thread tools

V was accurately turned and made normal with the axis by setting the job between parallel centers and turning it end for end. This provided for the Briggs thread.

A 55-deg. V was required for the Whitworth thread and this was also embodied in the tapered setting piece. The procedure in turning the 55-deg. V was however slightly different, for in this case the V must be normal to the tapered face of the setting piece. With the centers of the lathe set for parallel turning, a standard 55-deg. V-tool was set square with the axis of the lathe, the tool having a small radius on the point. Then without disturbing the tool the tailstock was moved so that the lathe would cut a taper of ¾ in. per foot, approximately, and the final accurate setting was obtained as described above. A 55-deg. V was then cut at a suitable place in the body, the cut being located normal to the tapered face and serving to set the thread

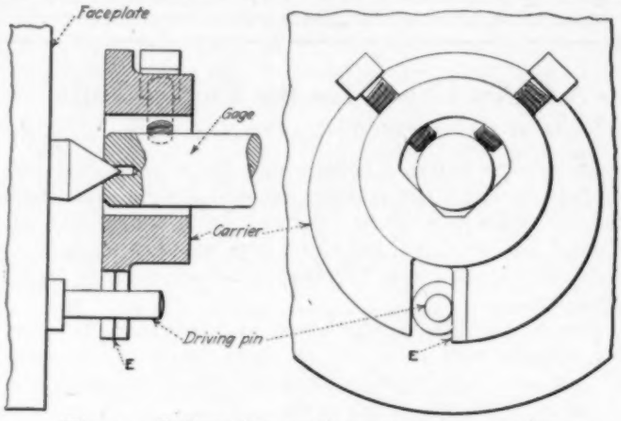


Fig. 2—Driver for uniform turning motion

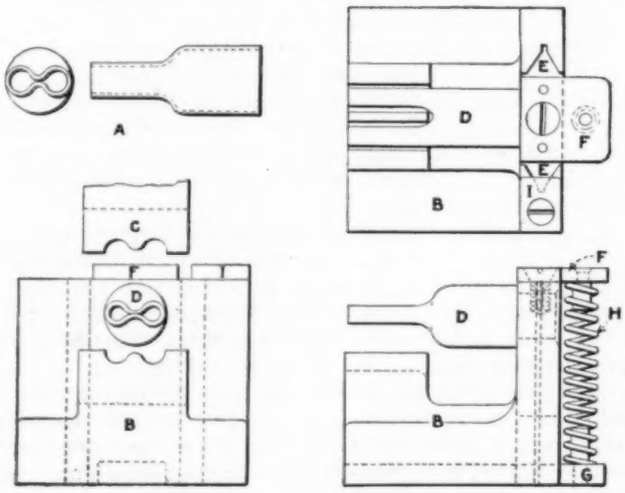
tool for the Whitworth gages. The small radius at the bottom of the cut was removed by another 55-deg. V-tool set to the sides of the cut.

To insure a uniform turning speed, a driver of the form shown in Fig. 2 was used, and the back face of this driver was set flush with the end of the gage. A driving pin was fitted squarely in the faceplate and made contact with the driver through the edge *E*. The line along this edge passed through the mean bearing point of the gage on the lathe center and no periodic error due to the setting over of the tailstock was then apparent, nor could any be discovered.

Tools for Forming a Duplex Ferrule

By S. A. McDonald

The duplex ferrule shown at *A* in the sketch is made from brass tubing for the reason that to make it of sheet metal would necessitate the making of blanking and drawing dies to a number and expense that the



Tools for forming a duplex ferrule

small quantity of product would not justify. The tubing is cut off to length in a screw-machine, after which it is ready to be formed.

The forming die consists of a cast-iron shoe *B*, a punch *C*, a mandrel *D* which is carried on the slide *E*, plates *F* and *G* to confine the coil spring *H*, and a stop-plate *I* to limit the upward movement of the slide. The die and punch—the latter made of machine steel—are machined so that one-half the form of the ferrule is in each. The mandrel is made to conform to the interior shape of the ferrule.

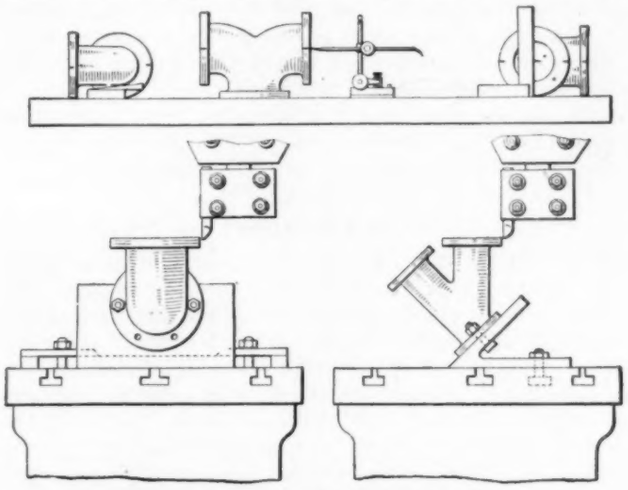
When one of the short sections of tubing is placed on the mandrel and the press is tripped, the punch carries the tube and mandrel down to the die, compressing the spring in its descent, and the double end of the ferrule is formed between the die and punch. On the upward stroke the spring returns the mandrel, with the formed ferrule upon it, to its original position, where the upward movement of the slide is arrested by coming in contact with the stop-plate.

A swinging guard is used to protect the operator's fingers.

Methods of Machining Pipe Fittings

BY JOE. V. ROMIG

Pipe fittings over four inches in diameter are usually made with flanges, and to machine these flanges true with each other is quite a job; especially on ell or other angular fittings. In most shops it is customary to machine the flanges first and drill the bolt holes afterwards; which method should be reversed if



Laying-out and machining pipe fittings

good and accurate work is to be expected in reasonable time.

Fittings should first be placed on the layout plate and levelled up, with the bodies and respective flanges in their proper planes. In this position it is easy for the layer-out to scribe the center lines, both horizontal and vertical, on the faces and edges of the flanges and get the centers on the inserted center-sticks from which to lay off the circles for the bolt holes. The holes can then be spaced off and drilled.

Angle plates, both 45 and 90 deg., should be provided for the boring mill, and should be drilled with holes laid out in circles of different diameters to correspond with the various sizes of fittings. These angle plates, fastened to the table of the boring mill, furnish substantial means of holding the fittings against heavy cuts and fast feeds. If the fittings are chucked or otherwise held before the bolt holes are made, it often requires more time to set them up than to take the cuts.

Two cuts should be taken over the face of all flanges; a roughing cut to get under and remove the sand and scale, and a light finishing cut to leave them true. This latter cut should be made with a round-nosed tool at a fast feed; the shallow spiral groove left by such a tool under this condition providing a surface that is ideal for holding the gasket material.

Flanges should not be turned on the back. They should be cast with bearing spots for the bolt heads and these spots, only, should be finished. This leaves the tough skin of the casting intact and results in a stronger fitting. All corners should be well filleted in the casting to avoid sharp corners and angles, which are likely to leave the fitting weak and to make an excellent place for the starting of cracks.

The working strength should be cast on the side of each fitting in plain figures; 125 lb. for medium pressures and 250 lb. for high pressures. This forestalls the danger of having a medium or low pressure fitting installed in a high pressure line.

Bolt holes should be staggered in relation to the longitudinal center line of the fitting. The holes should be at least $\frac{1}{16}$ in. larger than the bolts for bolts up to one inch in diameter, and $\frac{1}{8}$ in. larger for bolts above that size.

All fittings should be checked carefully for misplaced or shifted cores that leave a thin wall on one side. If it is impracticable to measure the wall thickness the test can be made by tapping the fitting lightly with a small hammer.

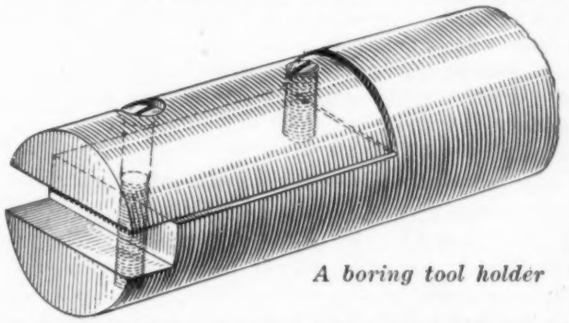
The sketches show the various operations and need no explanation.

Bar or Holder for Boring Tool

BY C. D. MICHENER

The sketch shows a method of holding a toolbit in a boring bar that will enable the user to bore to the bottom of a blind hole, and that does away with the necessity for keys or protruding setscrews.

A slot should first be cut across the end of the bar of a size to accommodate the desired toolbit, and the



A boring tool holder

holes then drilled and tapped for the screws; after which the clamping piece may be cut away from the bar with a hacksaw. The hacksawed surfaces need not be machined.

The countersunk-head screw should be placed as close to the toolbit as possible and should be a tight fit in the solid part of the bar, but should fit somewhat loosely in the clamping piece. It is not moved after it is once set. The bit is clamped or loosened by manipulating the headless setscrew in the opposite end of the clamping piece.

American Machinist
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KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Shall We Repair the Old Machine or Buy a New One?

IT SEEMS to be growing harder each year to know whether to repair the old machine or buy a new one. And it doesn't matter much whether it is a cheap watch, a low-priced automobile or a machine tool, we are confronted with the same problem.

In the case of the cheap watch it is usually better to throw it away in spite of the fact that we know it contains a number of gears and other parts that are perfectly good. The automobile is a somewhat different proposition, and yet it is approaching the same class as the watch. One Ford service station recently informed us that they never attempt to repair a crankshaft that is badly worn or sprung. The price of a new one is but eight dollars which is less money than it costs to have the old crankshaft made as good as new.

Machine tools have not yet reached this stage and possibly never will. Yet there are many cases where money spent for repairs should have gone toward buying a new machine. For even though the machine may be made to function satisfactorily it is quite probable that its production will be far less than that of a newer machine of the same or similar type.

In some cases the method of bookkeeping is at least partially responsible for unwise and unduly expensive repairs. This seems to be particularly true in some railroad shops where it is next to impossible to get new machine equipment and perhaps justifies them in what would otherwise be excessive expenditures for repairs. As an old engineer said when his locomotive had been kept in the shop a long time, "They jacked up the whistle and put a new engine under it."

It will pay any shop manager to watch the expenditures for repairs very carefully. New machines are frequently a much better investment, even if an appreciable amount of salvage is not recoverable from the old machine. Keeping close tabs on repairs will also give a good line on the cost of upkeep on machines of various types and furnish a guide in the purchase of new machinery.

The Railroads Are Undercapitalized

SENATOR LaFollette seems to have been wrong in his statement that the railroads are grossly overcapitalized. According to the *Wall Street Journal* the valuation work of the Interstate Commerce Commission has now reached a stage where approximate totals can be estimated. The most important feature of the work, from the taxpayer's point of view, is that one hundred million dollars, or thereabouts, has already been spent on the survey authorized in the bill sponsored by Mr. LaFollette. Of this amount, the taxpayers have had to stand one third while the balance has been charged to the railroads.

The final figures will probably show that the total value of our railroad properties is in excess of twenty-eight billions. Bear in mind that these figures are on a basis of 1914 when the purchasing power of the dollar was half again as much as it is now. The net amount of railroad securities in the hands of the public is about eighteen billions—par. The market value is considerably less.

It has cost us $100,000,000 to prove the senator from Wisconsin wrong but it may be worth the price if the weakness of his arguments and the faultiness of his judgment are made clear to his constituents and to the other members of the Senate.

The Revenue Bill in the Senate

SECRETARY Mellon's appearance before the Senate Finance Committee and his report on the results to be expected if the Longworth compromise becomes a law should have given that body something to think about. When the present Secretary of the Treasury gives an opinion on fiscal matters it is based on facts and is worthy of respect. An expert financier himself, he has also the advice of expert specialists on taxation matters and his interpretations of facts therefore carry weight with the people of the country if not with their political representatives.

The cardinal principle of the Mellon plan is that a reduction in surtax rates will increase the net return to the Government by diverting capital from tax-free bonds. It is a principle so obviously sound as proved by common sense and by the experience of other countries that the calm disregard of it by certain legislators of both political parties is exasperating, to say the least.

Nobody can guess what the Senate will do with the Longworth compromise. What you can do about it is to make doubly sure that the senators from your state know that you believe in the Mellon plan and expect them to do their best to force its adoption.

Just Suppose

JUST SUPPOSE each man in your bookkeeping department kept his books his own way; suppose each clerk in your ordering department had his own individual kind of order blank, and each man in the stock room had his own system of storing, handling and accounting. And suppose these men told you they had as much right to be individual as the man at the lathe, who is permitted to do the job as he thinks best and who grinds the tools as he wants them; that he does not want to be a machine and work to a system somebody else laid out for him, but that he knows which way best suits his personality. What would you say?

Oh, well, that is all nonsense, these men are no fools, at least not *such* fools. Probably not, but

Just suppose.

American manufacturers of industrial machinery should find encouragement in the statement by Mr. Rastall of the Bureau of Foreign and Domestic Commerce that export sales are likely to be divided by British and American interests, the Germans being out of the running for the time being. Competition will be on a fair business basis and American design and workmanship should be able to hold its own.

Shop Equipment News

Gardner No. 27 Double-Spindle Disc Grinder

The Gardner Machine Co., 410 East Gardner St., Beloit, Wis., is now marketing its No. 27, double-spindle, disc grinder. This machine has been given thorough tests in actual service and is said to have exceptional qualifications along the lines of accuracy, ease of operation, simplicity of adjustments, and rapidity in production.

As will be evident from the accompanying illustrations, the machine has two opposed spindles, each carrying at its inner end an abrasive disc wheel or an abrasive ring mounted in a chuck. The spindles are mounted in bearings in sliding heads so that the abrasive wheels can be fed against the work placed between them.

The feature of this grinder is the Oilgear hydraulic feed for operating the wheel heads, a mechanism that affords a nicety of control and relief from physical exertion of the operator. The sliding heads are operated by a double-acting hydraulic cylinder mounted on the left-hand end of the base casting. The piston is directly connected to the left-hand head and operates the other through a rack and pinion.

The oil is supplied to the cylinder by means of an Oilgear variable-delivery pump, mounted at the rear of the machine, as shown in Fig. 2. This pump may be driven either by an individual motor or from a countershaft, and is entirely self-contained and enclosed. A control shaft for the pump passes through the base of the machine to the front, where it may be operated by a suitable hand or foot lever.

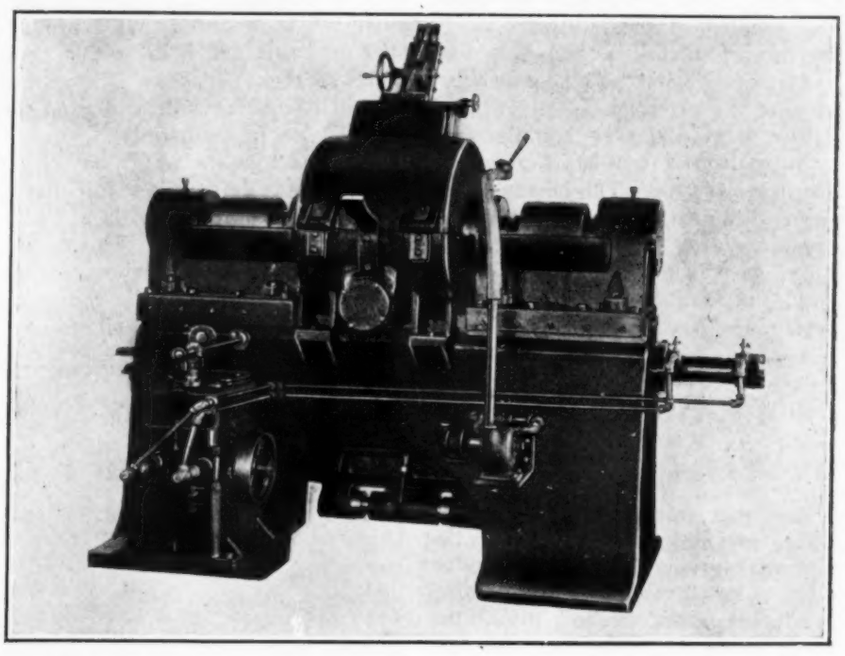


Fig. 2—Rear view of Gardner grinder showing Oilgear pump

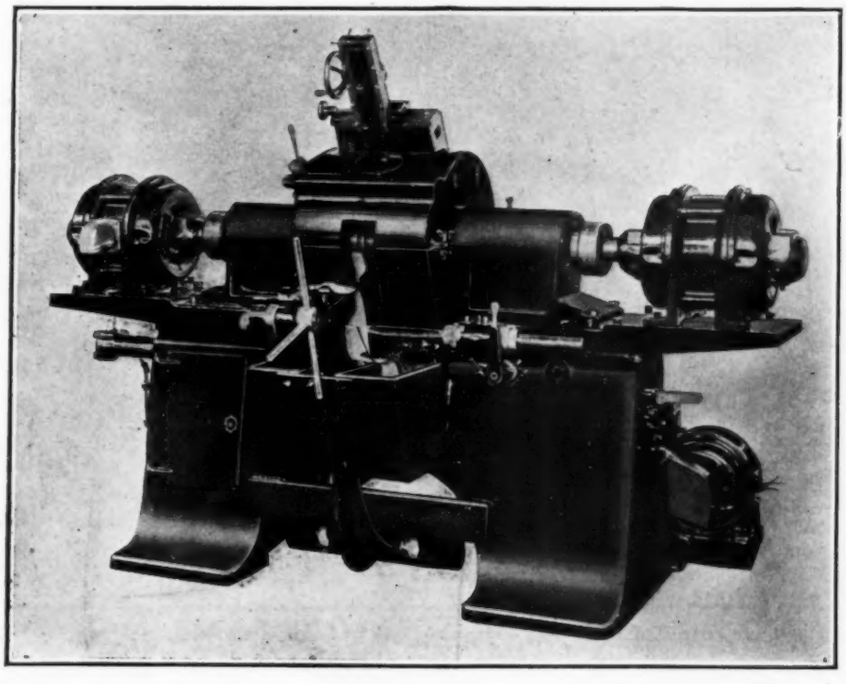


Fig. 1—Gardner No. 27 Double-Spindle Disc Grinder

The grinding pressure available through this feeding mechanism is greater than any wheel will stand, and two relief valves are therefore embodied in the pump, one for feed and one for return. These valves are accessible and the feed valve may be set to give the proper grinding pressure for each job. The distance the heads travel is regulated by a positive stop having a micrometer adjustment. This stop is placed directly on the sliding head and serves to hold the ground surface of the work to close limits.

The grinding wheels may be 20-in. steel disc wheels faced with Gardner improved abrasive discs, or 18-in. ring wheels carried in chucks. The wheels are entirely enclosed by a hood, an opening at the front just large enough for the work to pass being provided. The hood acts to confine the dust or spray as well as to guard the wheels, thus tending to keep the working parts of the machine clean.

The wheel-truing device is carried on a horizontal slide attached to the hood, and consists of a Ross dresser mounted in a vertical gibbed slide. The dresser is operated through a rack and pinion by means of a handwheel and is always ready for immediate use, although it does not interfere with the set-up or operation of the machine.

The large-diameter spindles are mounted in SKF ball bearings of the deep-groove type. The bearings are enclosed in dust-proof housings which provide a large lubricant space. The ways on which the heads slide are ample in size and are completely covered by the heads. This construction protects the sliding surface from dust and grit.

The work is held in a fixture mounted on a suitable counterbalanced swinging arm. This arm is hinged on a bracket bolted to the base of the machine, the hinge shaft being mounted in removable bushings. By attaching the arm directly to the base of the machine the fixture is guided accurately and the long radius of the arm causes the work to travel on a nearly horizontal line as it passes between the grinding wheels.

A job for which the machine is well adapted is the grinding of the ends of the eyes on automobile leaf springs. It is stated that a production of about 400 eyes or 200 complete springs per hour is possible, the springs being 2 in. wide and the eyes 1⅛ in. in diameter.

The machine is built for either belt or motor drive, the motor-driven type being equipped with a 7½-hp. motor on each spindle. The motors are mounted on extensions of the sliding heads and directly connected to the spindle flexible couplings.

Le Blond 11-in. Cone-Driven Rapid Production Lathe

An 11-in., high-speed, cone-driven lathe, particularly adapted for the quantity production of bronze or alloy parts involving plain turning or facing cuts, or for machining small parts from the bar, has recently been placed on the market by the R. K. Le Blond Machine Tool Co., Cincinnati, Ohio. Its field as a plain turning lathe can also be extended by the addition of chucks, draw-in attachment, and other devices.

An automatic back-facing attachment can be furnished, making the machine a small semi-automatic lathe, if desired. A taper-turning attachment is also available, but this lathe cannot be furnished with a screw-cutting mechanism.

The headstock is of the three-step cone, open-belt type without back gears, and is designed for spindle speeds up to 1,250 r.p.m. The headstock casting is constructed in such a shape that a large diameter cone pulley can be used, and provides a strong connecting web between the front and rear spindle bearings.

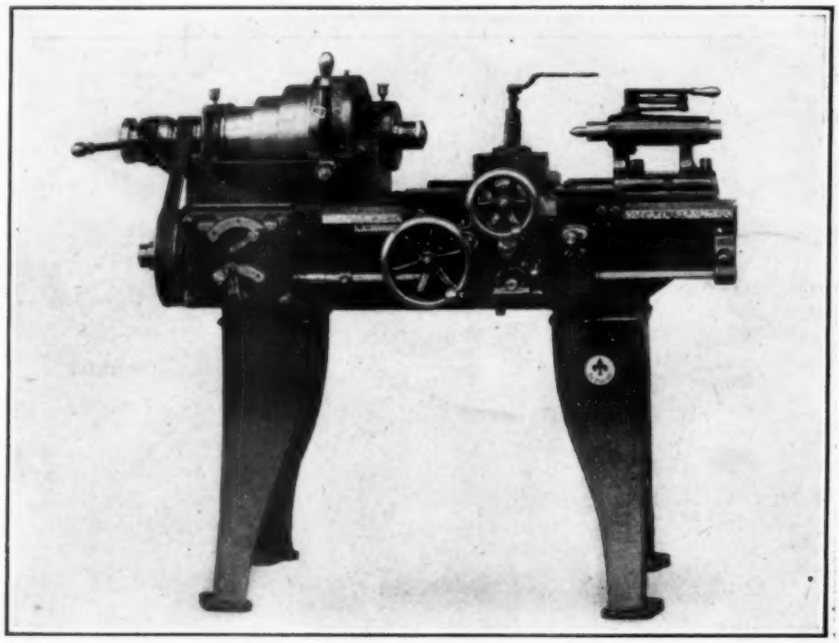
The spindle is machined from a high-carbon crucible steel forging and is mounted in ball bearings suitable for the high speed. The hole through the spindle is 1⅛ in. in diameter, and the 2⅜-in. spindle nose is threaded and bored for No. 3 Morse taper centers.

A multiple disk friction clutch is embodied in the largest step of the cone for starting and stopping the spindle. This clutch is operated by a lever conveniently located on the front of the headstock, and the movement of the lever in releasing the clutch applies an adjustable, cone friction brake, bringing the spindle to a quick stop. The driving cone is accurately balanced to eliminate vibrations at high speeds and runs on a substantial bronze bushing.

The bed is made from a semi-steel mixture and is well braced. The "compensating V" type of front shear is employed, as in other lathes made by this company, and presents a thrust bearing at right angles to the tool pressure. The carriage has a long bearing on the shears. A screw-operated tailstock is regularly furnished, but a quick-acting, lever-operated tailstock can be provided.

The lathe swings 13¾ in. over the shears and 8¾ in. over the carriage. The available distance between centers is 14¼ in., with a 4-ft. bed. The three-step cone provides three spindle speeds, 565, 825 and 1,250 r.p.m. The feed box provides nine changes of feed and these are obtained through the manipulation of two change levers. The feeds range from 0.008 to 0.092 in. per revolution of spindle, and are properly graded. The feed gears are of chrome-nickel alloy steel, heat-treated and hardened.

The carriage apron is a one-piece,

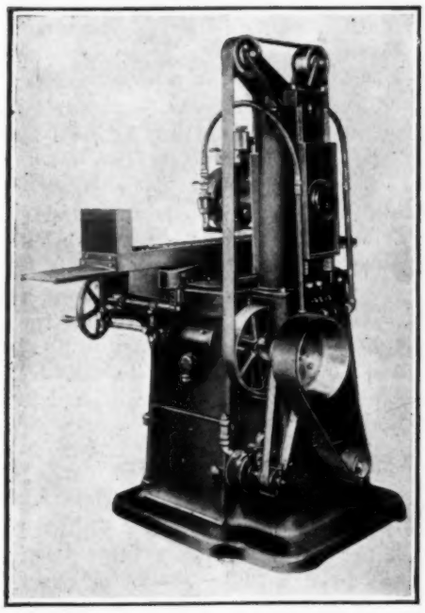


Le Blond 11-in. Cone-Driven Rapid Production Lathe

box-section design, in which all shafts and studs have a bearing at each end. The apron gears are of drop-forged steel. A single positive clutch controls both cross and longitudinal feeds, eliminating troublesome feed frictions.

Wilmarth & Morman Motor-Driven No. 78 Automatic Surface Grinder

The Wilmarth & Morman Co., Grand Rapids, Mich., is now marketing its No. 78 automatic surface grinder with a direct motor drive, the motor being located within the base of the machine. This location



Wilmarth & Morman Motor-Driven No. 78 Automatic Surface Grinder

protects the motor from grit, dust and water, reduces the amount of floor space formerly required for the machine, and makes it possible to guard all exposed belts easily. The use of ball bearings decreases the power required by the grinder, so that a 2-hp. motor is sufficiently large to drive the machine.

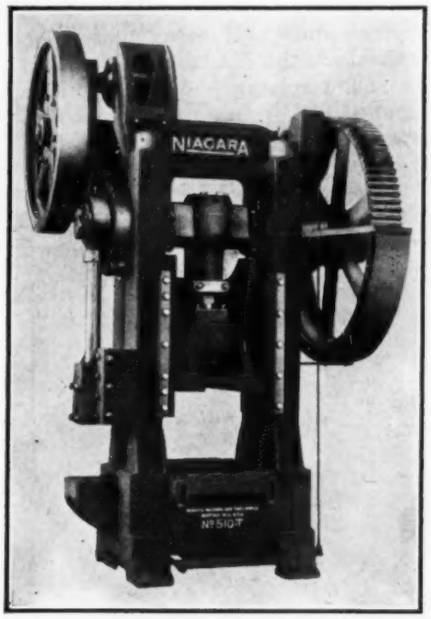
The control for the longitudinal table travel has also been improved. Heretofore, when changing from hand to automatic feed, it was necessary to disengage a pin located in the center of the hand wheel, in addition to operating the lever which threw either feed in or out. This pin has been eliminated and one movement of the hand lever is now sufficient to change directly from hand feed to automatic feed. The control wheel at the front of the table remains stationary instead of swinging back and forth. To reverse the operation, the hand lever is simply moved in the opposite direction, engaging the hand feed and automatically throwing out the power feed.

Another feature is the patented, ball-bearing type clutch which is an improvement over the former device, as it practically eliminates vibration and shock when the table reverses at each end of the stroke. The complete motor driven machine weighs 2,200 pounds.

Niagara No. 510-T Trimming Press

A recent addition to the line of power presses manufactured by the Niagara Machine & Tool Works, 637 Northland Ave., Buffalo, N. Y., consists of the No. 510-T trimming press shown in the accompanying illustration. This press is of the single-crank, straight-sided type, and is provided with an outer slide for trimming work.

The frame is made of four pieces, a bed, two uprights and a crown,



Niagara No. 510-T Trimming Press

bolted together and tied by four steel rods, shrunk into place. The rods are of sufficient capacity to carry the full load of the press and the uprights of the frame are not subjected to stress, so there is comparatively little danger of fracturing the frame through an overstrain.

The driving mechanism is mounted on the top of the machine where it will be out of the way of the operator. This location also protects the bearings from scale and dirt. The press action is controlled by the jaw clutch which is a usual feature of the presses manufactured by this company.

A dovetailed recess is provided in the bottom of the slide for mounting the dies, and the bearing surface for the dies is increased by flanges on the slide which extend toward the front and back. The dimensions of the bed are 40 in. from front to back and 27 in. from right to left. The standard stroke of the slide is 6 in. and a 4-in. adjustment of the slide is provided. The maximum distance from the bed to the bottom of the slide at the bottom of the stroke is 16 inches.

An outer slide is provided and is actuated by an eccentric keyed to the main shaft. This slide can also be adjusted vertically by turning the connecting rod which is threaded into the pivot block of the slide. The bottom of the outer slide has a round hole in which cutter holders or punch shanks can be fastened by a set-screw. The bed for the outer slide is cast integral with the frame and a round hole is also provided in this part for the accommodation of dies for punching operations.

The press shown in the illustration is arranged for an individual motor drive, the motor being supported on a bracket attached to the crown. The shipping weight of this press is approximately 27,000 pounds.

Rego Gooseneck Welding Torches

A recent addition to the line of Rego welding torches manufactured by the Bastian-Blessing Co., 246 E. Ontario St., Chicago, Ill., consists of a series of gooseneck torches. The model GL is shown in the accompanying illustration and two smaller models can also be furnished.

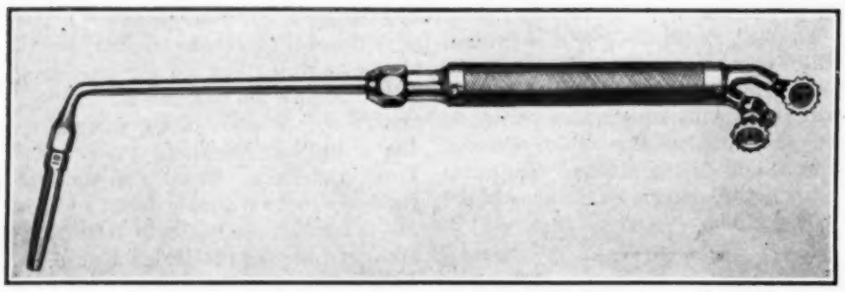
These gooseneck torches are guaranteed against flashback, and the objectional feature of mixing in the handle is eliminated. A wide range of tips can be furnished, the tips being of the nickel-copper heat-resisting type.

The model GL is furnished with three extensions, 6, 12 and 24 in. long, respectively, and ten tips. These extensions and tips can be furnished complete or in any assortment desired. It is stated that this torch is adapted to a wide range of work and that the assortment of extensions

and tips make it available for any welding from the heavy preheated job to light sheet metal work.

The next smaller model, GM, is a medium torch for work up to 1 in. thick. It can be used on iron, steel, copper, bronze and aluminum, and is adapted to such work as pipe welding, automotive repair and production, tank and other medium welding.

The model GS is limited in its use to ⅛-in. stock and is used on light production welding work. This torch is 14 in. long and weighs 15 ounces. It is furnished with five tips to suit a variety of work.



Rego Model GL Gooseneck Welding Torch

Barnes No. 263 Drilling and Tapping Machine

A machine designed especially for high production drilling and tapping operations, known as the No. 263, self-oiled, all-geared, sliding-head drilling and tapping machine, is now being marketed by the Barnes Drill Co., 820 Chestnut St., Rockford, Ill. A number of improvements, including the self-oiling feature, have been made in the design of the machine over the standard 26-in. all-geared drilling machine, which it is intended to replace for high production work.

As modern production methods require a rigid table with adequate support, the machine is made with a square column and rectangular table, as shown in the illustration, although the round column and table will be supplied, if desired. An improved type of spur geared feed is used in place of the usual worm and gear. The speed change gears are cut from chrome nickel steel bar stock, heat-treated and tempered, and the crown and pinion gears are of steel. Eight changes of both geared feeds and speeds are provided, and any speed or feed can be instantly selected by the operator without stopping the machine. No slip gears nor belts are used.

Another feature of the machine is the manner in which the rack is attached to the spindle sleeve. The rack is dovetailed into the sleeve and keyed in position so as to take the thrust, making it impossible for the rack to work loose. No dowels nor screws are used. The spindle is $1\frac{13}{16}$ in. in diameter and double splined, the sleeve being $3\frac{1}{2}$ in. in diameter and having $15\frac{1}{2}$ in. travel. The drift hole is below the sleeve.

The head and spindle are counterbalanced, the weight being suspended by a roller-bearing sheave. The other sheaves are accessible for oiling. The head is gibbed to the column face by a dovetail construction, insuring good alignment, and can be held at any point in its travel by two quick-acting clamp screws. The head is raised and lowered easily and quickly by means of a crank-operated pinion and rack, a desirable feature for boring bar and deep hole work. An adjustable stop may be clamped to the column face, so that the sliding head can be quickly returned to the desired position each time the head is raised.

Boring and Tapping

Suitable feeds are available for boring bar work, and the machine will, it is said, drive a 2-in. high-speed twist drill at a feed of 0.041 in. per revolution of the spindle, or at the rate of $6\frac{1}{2}$ in. per minute in cast iron, without the back gears.

When the machine is used for tapping, a reversing friction clutch gear is employed, the gear being located on the driving shaft of the machine. The trip can be set so that the spindle will automatically reverse, as soon as the tap has reached the required depth, backing out at a speed which is increased by a ratio of $1\frac{7}{8}$ to 1. The shifting lever can also be set so that when tripped either automatically or by hand, it will return to the neutral position, thus stopping the spindle instantly instead of reversing it. A small hand trip lever is within easy reach if it is desired to reverse or stop the spindle at any point in the course of the operation.

The machine is 94 in. in height and occupies a floor space 24 x 29 in. The complete machine weighs 2,000 pounds.

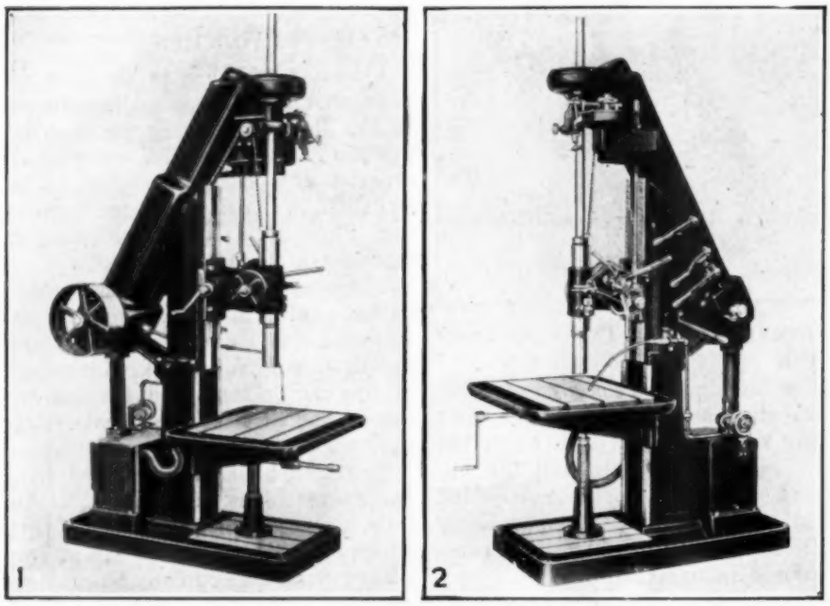


Fig. 1—Barnes No. 263 Drilling and Tapping Machine. Fig. 2—View of right side of machine showing control levers

Brown & Sharpe No. 2-I Universal Grinding Machine

A universal grinding machine with a constant-speed drive, known as the No. 2-I, is now being marketed by the Brown & Sharpe Manufacturing Co., Providence, R. I. The features of former models of grinding machines made by this company are incorporated in this model and additional productive features have been built into the design. Among these may be noted the automatic lubrication of the various operating mechanisms and the centralization of all control and operating levers.

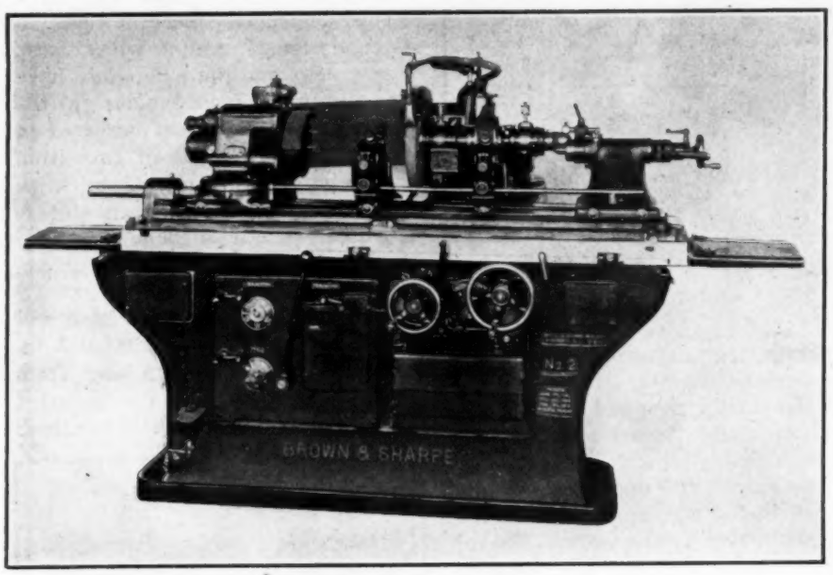


Fig. 1—Brown & Sharpe No. 2-I Universal Grinding Machine

The convenience of the controls is shown in Fig. 1, a front view of the machine. The table and work are controlled by the hand lever located slightly to the left of the center. The same lever actuates a brake for stopping the table and work. The various other levers are so located that it is not necessary for the operator to change his position.

The machine takes work up to 14 in. in diameter by 36 in. in length and swings 12½ in. over the water guards. The single-pulley drive shaft runs on ball bearings at a constant speed of 900 r.p.m., the drive pulley being 8½ in. in diameter. The machine is adaptable for motor driving and, when so arranged, the motor is fastened to the floor and drives the pulley by means of a belt.

The grinding wheel driving pulley is fastened to the main driving shaft at the rear of the machine, the face of the pulley being of exceptional width to allow the belt to compensate for the varying position of the wheel slide. From the driving pulley the wheel spindle is driven by a belt which passes over a series of roller-bearing idlers, so arranged in a swinging frame that an even tension is kept on the belt regardless of the position of the wheel slide. An adjustment is provided for the stretch of the belt and the different diameters of pulleys by which the various wheel speeds are obtained.

The lubricating oil tank is located in the base of the machine and the oil is pumped to the various units of the mechanism. This system provides flood lubrication for the greater part of the machine, and bearings not automatically lubricated are provided with sight-feed oilers or grease cups. The oil is automatically shut off when the table operating mechanism is not running.

The alloy steel wheel spindle runs in hardened, ground and lapped bearings, fitted with adjustable, self-aligning, bronze boxes. The maximum diameter of wheel is 14 in. with a thickness of from ¾ to 1½ in. The wheel slide swivels, the angle of setting being measured by graduations on the base, and in addition, the wheel platen can be swung to a maximum angle of 10 deg. This enables the grinding of two different tapers at one setting.

The handwheel for controlling the hand cross-feed and quick traverse is located on the front of the machine and has two positions; one to engage the hand cross-feed and the other to disengage the hand cross-feed and engage the quick traverse. The automatic cross-feed ranges from 0.00025 to 0.004 in. for each reversal of the table, and can be set to throw out automatically when the work has reached the required diameter. When the table is stationary the wheel is fed to the work by means of an independent automatic cross-feed, the table being secured by a safety lock which prevents the traverse.

The table ways have large bearing surfaces and are protected by metal covers. The table turns on a cen-

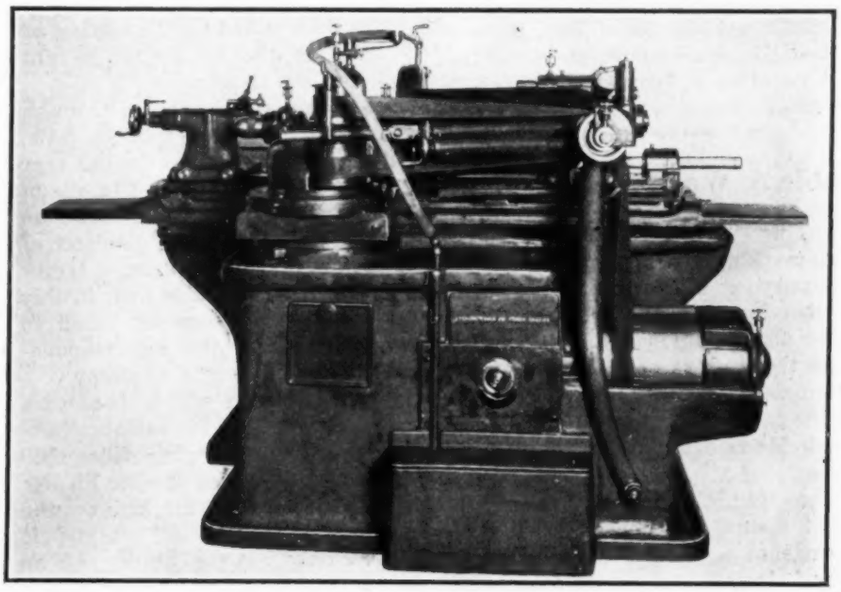


Fig. 2—Rear view of Brown & Sharpe grinding machine

tral pivot bracket and can be set at an angle with the ways, clamps being provided at both ends to secure rigidity. The reversing mechanism functions with sufficient accuracy to permit the grinding of work close to a shoulder.

The speed of the wheel, the speed of the work, and the feed of the table are independent. Four wheel speeds, ranging from 1,500 to 2,400 r.p.m., are available, and there are 12 indicated changes of work speed from 24 to 492 r.p.m. The 12 changes of table feed can be divided into a fast and a slow series, the former ranging from 6 to 24 in. per min., and the latter from 33 to 128 in. per min. The feeds and speeds are obtained by two rotating levers at the front, a dial beside each lever indicating the speed or feed in operation.

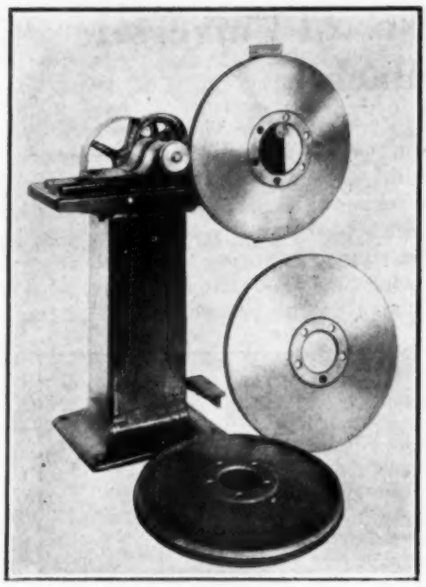
The work drive plate on the table headstock is driven from the main driving shaft at the rear of the machine through a system of gears and shafts that provide the required flexibility. The headstock swivels on a graduated base and also slides on ways, to which it can be clamped at two points. The 2-in. spindle is hardened, ground and lapped and the threaded front end is provided with a No. 9 taper hole. The spindle can be locked for grinding on dead centers. The footstock also slides on ways and a holder for a carbon point is attached to it. The wheel can be dressed without removing the work from the centers.

A cooling water tank is cast in the base and the pump requires no priming or packing. A variety of equipment including faceplate, chucks, overhead works, etc., is furnished. The machine weighs 6,950 lb. and requires a floor space 42⅝x142 inches.

Noble & Westbrook Flange-Marking Machine

A marking machine designed for the purpose of stamping the size, number and trade-mark upon the inner flange surface of disks that form the centers of disk wheels for automobiles, has recently been placed on the market by the Noble & Westbrook Manufacturing Co., Hartford, Conn.

The stamp is in the form of a roll, 3 inches in diameter, having the permanent portion of the lettering in raised characters upon its periphery. The numbers and sizes appear upon



Noble & Westbrook Flange-Marking Machine

separate segments that fasten into the periphery of the stamp roll and can be easily changed to suit the dimension and character of the work to be done.

The stamp roll upon the machine shown in the accompanying illustration is hidden by the work. The roll that is exposed turns idly upon its supporting stud and is employed to apply the pressure necessary to sink the characters of the stamp roll into the metal of the work. This pressure roll, with its stud, is mounted upon a horizontally sliding head that is operated to and from the work by means of a treadle and a connected toggle lever, so that the amount of movement, and the consequent pressure, is determined by the setting of the machine and not by the weight applied to the treadle.

The stamp roll is driven through back gears, having a 1 to 15 ratio, from the driving pulley in the rear of the machine. With a 3-in. diameter stamp roll a stamp 9 in. in length is available. The diameter of the stamp roll is, however, a factor of the work to be done and, in this case, could have been increased to 6 in. if desirable, with a correspondingly increased length of stamp.

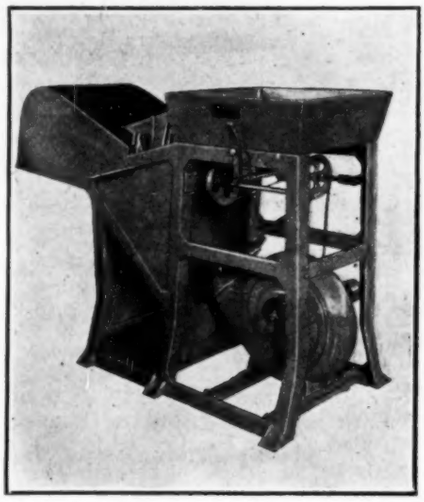
The stud upon which the work hangs is adjustable for various diameters, and by changing this stud other disks or pieces similar to disk wheels can also be marked on the machine. The rate of output is limited only by the ability of an operator to handle the work to and from the machine.

McKenzie Screw Machine Product and Chip Separator

The McKenzie Engineering Co., New Rochelle, N. Y., has recently made several improvements in the design of its machine for separating finished parts from chips after the oil has been extracted. The former model was described on page 880, Vol. 38, of the *American Machinist*.

The improved machine has a stronger frame and a wider base. The screens and the side chute have been eliminated from the design; the receiving box has been increased in size and is now made of cast iron. A specially designed blower with ring-oiled bearings on each side is now furnished, a suitable cut-off for adjusting the air blast being arranged in the discharge pipe.

It is stated that the machine will separate parts as small as 0.063 in. in diameter and ⅛ in. long from chips, and also from the long curled steel chips, even when badly bunched.



McKenzie Screw Machine Product and Chip Separator

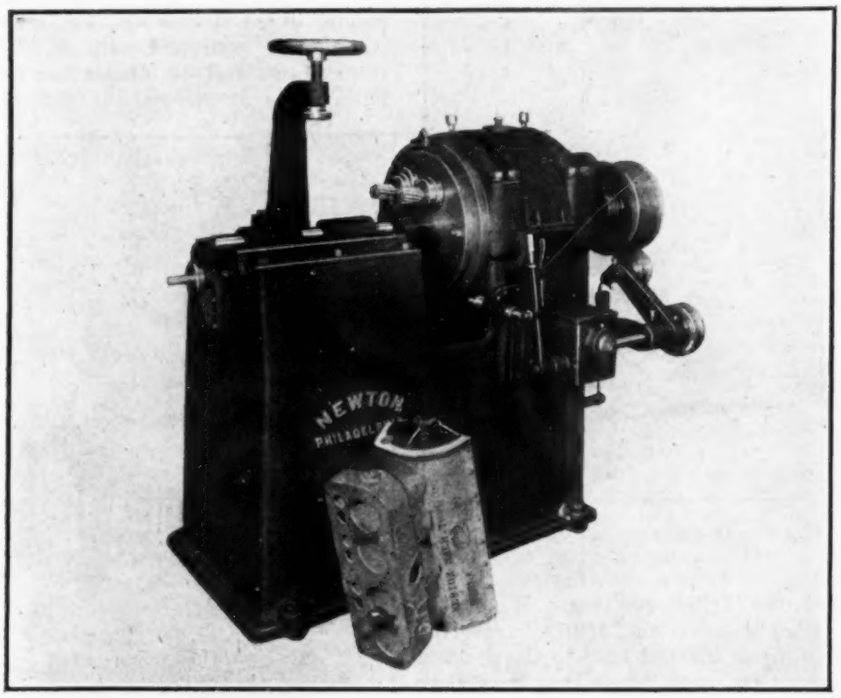
The capacity of the machine is about one bushel a minute, or the entire production, under certain conditions, of 500 screw machines.

The operator takes the pan of parts and chips from the oil extractor, empties it into the receiving box and regulates the air blast to suit the size of the parts to be separated. The contents of the box is then pushed into the chute and the machine automatically spreads the material, shakes the parts loose, and blows the chips into a box or barrel at the rear. The finished parts fall into a separate box.

Newton Planetary Type Radius Milling Machine

For milling the ends of automobile crankcases, the Newton Machine Tool Works of the Consolidated Machine Tool Corp. of America, Wilmington, Del., has recently developed and is now marketing a planetary type milling machine.

The machine is equipped with two spindles, one of which carries the roughing cutter and the other the finishing cutter, both being driven by spur gears that mesh with a pinion on the driving shaft. Both spindles are adjustable radially and the roughing spindle also has a longitudinal adjustment to compensate for the wear of the cutter.



Newton Planetary Type Radius Milling Machine

The spindles are mounted in a drum, the rotation of which is produced by a worm and wormwheel. The drum rotates at the rate of 0.58 r.p.m., giving a feed of 17.4 in. per min. on a 9½-in. diameter milling circle. The driving gears are of steel and bronze with the exception of the wormwheel on the drum, which is of cast iron. All gears are fully enclosed and run in oil.

The drum is equipped with a hardened steel dog which automatically trips the feeding mechanism after the cutters have completed one cycle. When the work fixture has been reloaded, the feed is engaged manually by means of a conveniently located lever at the front of the machine.

The work-holding fixture is fitted with taper gibs and can be adjusted longitudinally by means of a micrometer screw. The work is located on a bar that fits into the crankshaft bearings, and rests upon hardened steel plates. A locating pin is provided for proper positioning, and the work is clamped down by a large screw clamp mounted in a bracket.

The illustration shows a machined crankcase at the side of the machine, and it is said that such pieces can be milled as shown at the rate of 250 per eight-hour day.

Rotary File Co. Files

The Rotary File Co., 1570 Richton Ave., Detroit, Mich., has recently placed on the market the rotary files shown in the accompanying illustrations. These files are intended to lessen the inconvenience of hand filing and fitting punches to dies.

A straight rotary file is shown in Fig. 1 and is held in a drill chuck. The work to be filed is brought against the revolving file with a gentle pressure and the action is similar to that of an end mill.

The filing of break clearance requires a great deal of skill and is a costly operation when performed by hand. Fig. 2 shows a rotary break clearance file in which the shank is smaller than the body by the amount of break required. When the shearing edge of the punch is finished, the body of the punch is filed away until the shank of the file comes into contact with the finished edge. The edge acts as a stop and a guide and it is impossible to file an excess of clearance. The break clearance will be even all around the punch, even with intricate contours.

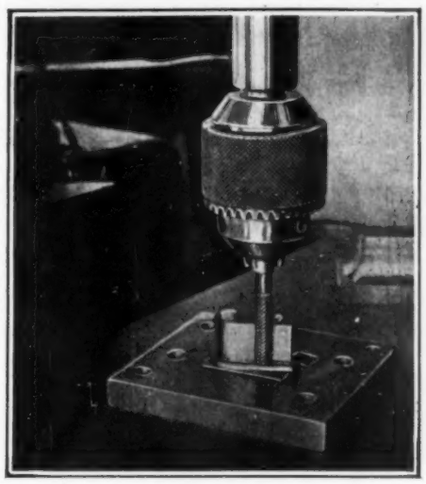


Fig. 1—Rotary File Co. Straight File

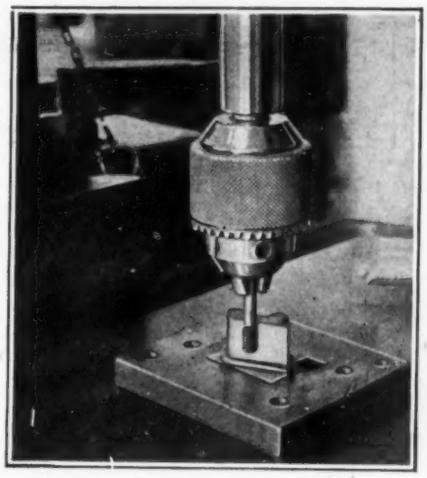


Fig. 2—Rotary Clearance File

Land-Matic Diehead

The automatic diehead made by the Landis Machine Co., Waynesboro, Pa., described on page 976, Vol. 56, of the *American Machinist*, has recently been designated the Land-Matic diehead. The head supports the chasers on the outside, permitting easy access for grinding or changing.

Fox Special Drilling and Tapping Machines

The Fox Machine Co., Jackson, Mich., has recently placed on the market three special multiple-spindle drilling and tapping machines that are designed to perform these operations at a high rate of speed.

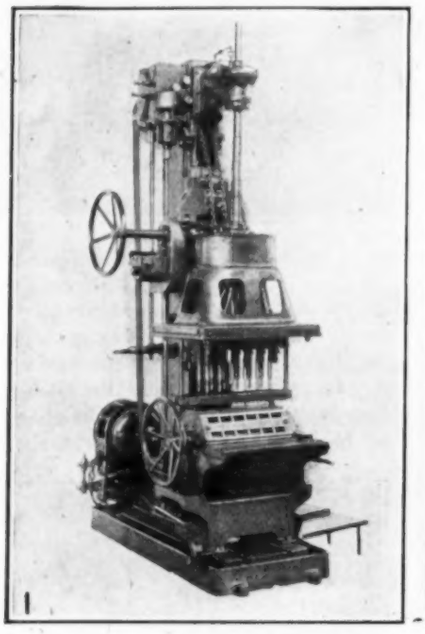


Fig. 1—Fox Special Drilling Machine.

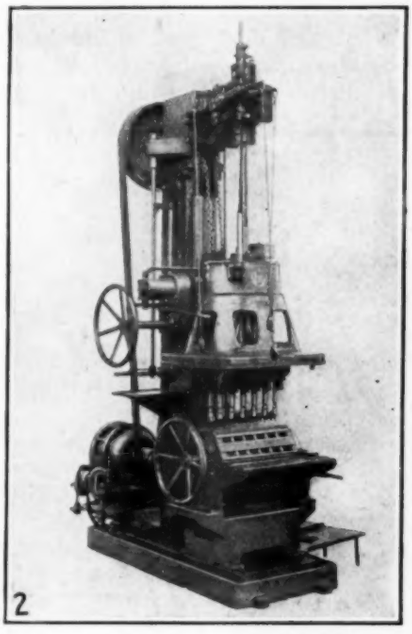


Fig. 2—Fox Special Tapping Machine

The machines shown in Figs. 1 and 2 are for drilling and tapping, respectively, pole pieces for small electrical machines. The rate of production on each machine is 2,160 pieces per hr. The automatic drilling machine, Fig. 1, has 12 spindles carried on a cluster plate and the jig is carried with the head. Two views of cluster plates are shown in Figs. 4 and 5, and these plates make it possible to assemble a large number of spindles in a comparatively small space. They will be described in detail later.

The head of the drilling machine, Fig. 1, is reciprocated automatically by a properly developed cam that provides a quick return. The work table is a hexagonal drum and has sufficient carrying capacity on each face for 12 pole pieces, the pieces to be drilled being loaded on the table at the front position. When the head goes up the drum is revolved to bring the last load to the drilling position, while those that have been drilled drop out at the side.

The tapping machine, Fig. 2, is also automatic and is similar to the drilling machine, except for the tapping mechanism. The 12 spindles are mounted on a cluster plate and carry the taps mounted in floating holders. Twelve pole pieces are tapped at one time, the arrangement of the work table being the same as for the drilling machine.

When the work is loaded and the table is rotated to the working position, the operator pulls the right-hand cord or touches the pedal at the lower right-hand side of the machine. This starts the taps revolving in a right-hand direction, and also starts the head downward at the same speed with which the taps thread into the work. At the proper depth the machine automatically reverses, stopping automatically at the top of the stroke unless continuous action is desired.

The special machine illustrated in Fig. 3 is designed to drill three automobile brake drums at once. This machine is equipped with a 22-in. rotary table and the drums are held on fixtures as shown. It will also be noted that the spindles are carried in a cluster plate and that the jig is attached to the head.

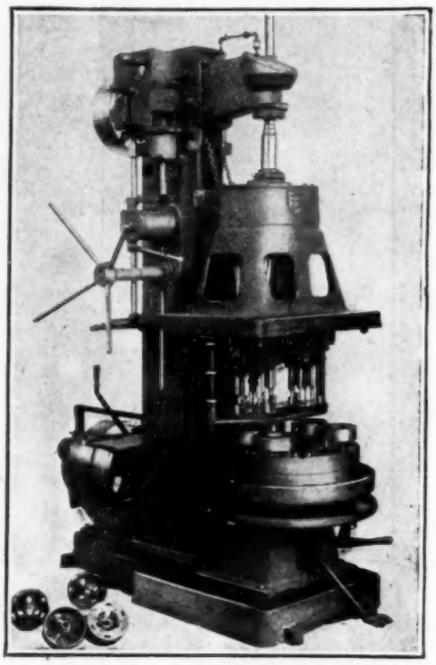


Fig. 3—Fox machine for drilling brake drums

A view of the cluster plate for this machine, taken from underneath, is shown in Fig. 4. There are 18 spindles arranged as shown, and the plate is attached to the bottom of the head, the ends of the spindles on the other side of the plate being connected to the main spindle by means of the usual universal joints. The arms that hold the spindles in position are bolted and doweled securely to the plate.

The cluster plate illustrated in Fig. 5 has 32 spindles and this view gives a good idea of the large number of spindles that can be assembled in a small space. As in Fig. 4 the under side of the plate is shown.

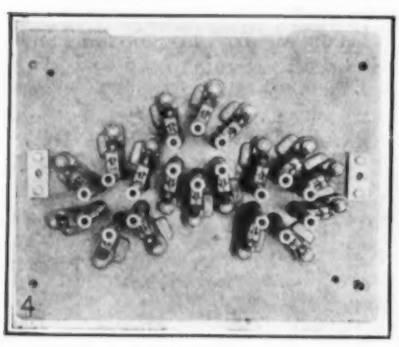


Fig. 4—Cluster plate for brake drums.

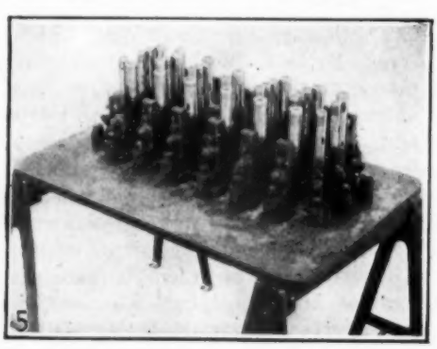


Fig. 5—Plate with 32 spindles

News of the Week

Steel Corporation Reports it Will Spend Ninety Millions for Improvements

Numerous expansions are planned during the year

Compared to 1922, when the United States Steel Corp. failed to earn dividends by $10,981,347, the report for 1923, released this week, shows surplus net income, after dividends, of $54,259,993, an increase of $65,241,340. Balance carried to undivided surplus, $14,259,993, represented a gain of $25,241,340.

Volume of business transacted by the corporation and its subsidiaries totaled $1,571,414,483, nearly $500,000,000 more than the year before. Total earnings reached $179,646,674 after deducting expenses, taxes and interest, and net income was $128,176,519.

The corporation has authorized expenditure of $90,000,000 for new plant construction and improvements in 1924. This amount includes the unexpended balance for work authorized during 1923 and is said to be a record peacetime outlay for any one year.

In point of tonnage output, 1923 was exceeded by only two previous years, 1916 and 1917. "As a result of these larger operations," says the report, "together with improved selling prices, the earnings for the year show a substantial increase over those of the preceding two years."

Undivided surplus at the close of the year, exclusive of profits earned by subsidiary companies on intercompany sales of products on hand, totaled $512,751,219. This compared with a surplus or working capital of $25,000,000 when the corporation was formed, April 1, 1901.

The Year's Business

Improvement in demand for iron and steel products, which developed in the early fall of 1922 after nearly two years of depression in the industry, continued in satisfactory volume until June, 1923, following which there was for several months a decided dimunition in the amount of new business offered, the report says.

In the closing months of the year, however, there was a noticeable improvement in tonnage entered and this continued to the date of the writing of the report. At the close of 1923, the tonnage of unfilled orders for various classes of rolled steel products was 4,445,339, compared with 6,745,703 tons at the close of the preceding year. Feb. 29, 1924, the unfilled orders equalled 4,912,901 tons.

"The prices received in 1923 for the 13,196,298 tons of rolled and other steel products shipped to the domestic trade," the report said, "netted an average of $8.87 more per ton than the average price per ton in 1922 on an equivalent tonnage of similar products shipped; and in respect of the 1,177,524 tons of export shipment, the 1923 prices received netted $10.03 more per ton than the average price obtained in the preceding year."

The corporation had an average of 260,786 employees in 1923, compared with 214,931 in 1922. Total salaries and wages paid reached $469,502,634, as against $322,678,130 the previous year. Average earnings of all workers, exclusive of general administrative and selling force, was $5.73. This compared with $4.78 in 1922. Total employees, including general administrative, and selling force, averaged $5.83, against $4.91 the previous year.

Expenditures by the corporation and subsidiary companies for the year for the acquisition of additional property, additions, extensions and the like totaled $60,762,920. Of this amount $35,416,609 was expended on manufacturing properties, $8,079,269 on coal and coke properties, $5,313,516 on iron ore and fluorspar properties, $11,128,785 on railroads, docks, Great Lakes and ocean going steamships.

Good Report Expected from American Car

The American Car & Foundry Co.'s earnings for the current fiscal year ending April 30 are expected to show an increase over the previous fiscal year when net for the 300,000 common shares was $4,113,611 or $13.71 a share. Final showing for the period will be affected somewhat by year-end adjustments.

Incoming business, which declined steadily in the latter part of 1923, has picked up decidedly in the past six or eight weeks and the company now has its plants booked ahead for four or five months on the average.

Because of this large amount of unfilled orders it is likely that inventories as of April 30 will be heavy, although probably smaller than the $29,111,488 reported on April 30, 1923. As American Car & Foundry carries a very small amount of stock goods and inventories are only accumulated against definite contracts, a big material and supplies account is an indication of good business.

American Car & Foundry still has untouched the reserves set aside several years ago to cover three years' dividends on its common stock. From present indications this reserve will continue untouched for some time.

There is no foundation for reports that the company is planning to distribute as a special dividend its holdings of American Locomotive common stock.

Hearing Held on Patent Laws

Approval of the Cramton bill to prohibit persons, corporations or associations not authorized to practice before the Patent Office from misleading the public "by word, circular, letter or advertisement" in connection with business before that agency was given at hearings before the House committee on patents March 14 and 15 by various witnesses. A hearing for opponents of the bill will be held later, the date not having been fixed.

Among the witnesses in behalf of the measure were Representative Louis C. Cramton, of Michigan, author of the measure; Thomas E. Robertson, commissioner of the Patent Office; Thomas Ewing, vice-president of the New York Patent Law Association and former commissioner of patents; and J. W. Knight, who has charge of patent law cases for the Department of Justice.

Cramton's Theory

In explanation of his bill, Representative Cramton said that the present law, which authorizes the commissioner of patents to disbar patent attorneys for misconduct after a hearing and with the right of appeal to the Supreme Court of the District of Columbia, does not reach cases where persons unauthorized to practice before the Patent Office may victimize the gullible under cover. Cases of persons never registered at the Patent Office and others of persons disbarred conducting business under other names were cited by Mr. Cramton. Under existing law, it is difficult to reach such cases, even through prosecutions through the Post Office Department for using the mails to defraud, he said. The bill would prohibit advertisements by those not authorized to conduct business before the Patent Office.

Commissioner Robertson recited numerous specific instances of fraud which had come to his attention, but which cannot be reached by his office under the existing law. Individuals or organizations are operating in questionable ways in the District of Columbia, Kansas, Massachusetts, Missouri and Oklahoma, he stated. There are 9,690 patent attorneys registered, he said, explaining that it is not necessary that a patent attorney be a member of the bar.

Spain as a Potential Machinery Market Under the New Dictatorship

The ambitions and possibilities of the Spaniards

Some of the manufacturers and also some of the dealers seem to think that American machine tools cannot be sold, due to their high prices and their rapidity of production, in the Spanish market. Both theories are wrong. American, high class machines, with great production can be sold in Spain just as well as they are in America, but naturally only to those factories that really can use them.

It is a well known experience that a man who ever had a first-class American machine will never turn back to a cheap product, and experiences with cheaper machinery in the government plants have shown that in an emergency —as there was at a time for the manufacture of shells and airplane bombs for the Moroccan war—only the American machines did stand up. European machines of more or less the same quality as American products also cost about the same price and are proved to be copies of American types. It is evident that a customer will prefer the American original, to a European copy when the price is approximately the same.

Preparations Needed

Before you enter the Spanish market ask yourself if you are really interested in it, if the amount of business to be obtained warrant your entrance. You can get the answers to these vital questions by consulting the statistics of the Chambers of Commerce of U. S. A., France, Germany, Great Britain, Czechoslovakia and Italy. Compare these statistics with those given out by the Spanish government in regard to imports from each country. When you learn that the quantity of the commodity you are interested in is of sufficient importance, find out then about the quality and price of your competitors. When your price is considerably higher use your common sense and judge impartially to ascertain if it will be possible for you to obtain your price. Check your conclusions with someone who is well acquainted with the Spanish market.

After having reached a satisfactory decision, open your own branch if the amount of business makes it advisable. The branch must officially be a Spanish company, as the Spanish law provides for a heavy direct tax on the capital not being Spanish and working in Spain with a foreign company. If the potential market does not justify the establishment of a branch, then find a good reliable agent who must know conditions thoroughly as well as the Spanish language. Keep in mind that a foreigner in Spain is always somewhat better considered than a native, but he ought to understand Spanish ways of thinking and living and make allowances correspondingly; also it must not be forgotten that the average Spaniard has a surprisingly high natural intelligence.

Neither underpay nor overpay your Spanish employees. It will always be expected that an American house pay its people better than any others. Have an understanding for their credit management and never sell to a man whose information is only good from a viewpoint of capital; it is more secure to deal with people having good reports in regard to their "business behavior."

It is to be recommended that you try to understand and help overcome such difficulties as occasionally arise through port strikes, congested conditions with the railroads, slowness of bank collections and also the conservative attitude of buyers when changes occur in the government. The new disctatorship, composed of a council of Army and Navy officers, was welcomed by the entire population, excepting those who belonged to the old régime.

It was found out after three or four months, however, that those military men who brought about the movement and who acted with the best of intentions, weeding out old and bad elements in all governmental departments, abolishing out-of-date and bureaucratic institutions, had not yet been able to build up new, efficient organizations. The immediate consequence is the manifest uncertainty of all business people who only place such orders as are absolutely necessary to keep their companies just going.

This happening, combined with the immediate standstill when in September last year the Dictatorship came in, account for the small orders being placed now. All those Government orders for which credits were under consideration or that had been issued and not used yet, were immediately held back by the new government, but it is expected they will be placed this year.

It might be said that the actual situation in Spain is that of waiting, but it is hoped and expected that the military dictatorship will soon develop, according to its promise, into a civilian form of administration and of a lasting character, permitting the Spanish capitalists to finally invest their money in their own country. When this takes place the demand for all kinds of machinery will be very large as big problems are under consideration, such as the electrification of railroads and simultaneously the taking over of these companies by the Government; the exploitation of the resources in waterfalls; irrigation projects; efficient working of the important coal mines; and oil land development.

The low value of the peseta compared with the dollar retards business with the United States but this is not a critical situation for exchange is fairly stable with a tendency to become better from month to month.

Many New Factories on Pennsylvania

According to a report just compiled by the Pennsylvania railroad industrial department, 513 new industries, developing traffic estimated at more than 6,500,000 tons annually, were established on its lines last year. This growth of industries was the greatest on any railroad in the country, the compilation shows. The newly established enterprises are expected to load more than 186,000 freight cars a year. Provision already has been made for the construction of 237 private sidings to handle the increase.

Practically every kind of raw material and manufactured product is represented in the output of the new projects. Textiles, automobiles and accessories, building materials, chemicals and paints, and iron and steel products made up the major portion of their production, while electrical supplies, food and fuel products and leather goods are also well represented.

Olds Car Bodies Made at Lansing Plant

Another step toward becoming a wholly self-contained automobile factory was taken by the Olds Motor Works last week, when its production line and that of the new Fisher Body Corp.'s plant in Lansing, Mich. were joined and the first car body moved through the archway separating the two buildings. The Olds Motor Works now is one of the few automobile factories in the world where all of its bodies are built in the same place that the chassis and engines are manufactured. The change eliminates the shipping of Oldsmobile closed bodies to Lansing, and removes any chance of the bodies being damaged in shipment. It also will permit an enlarged production schedule, said to be needed to meet demands for the new Oldsmobile six.

A. J. Brandt, for the past seven years identified with the du Pont and General Motors companies, was brought from the large Fisher plant at Janesville, Wis., to act as division manager of the new Lansing plant. Frank Wilson, for the past three years in charge of the finishing of Oldsmobile open and closed bodies, has been made manager in charge of painting and finishing.

More Locomotives Are Ready for Service

Class 1 railroads on March 1 had 11,304 locomotives in need of repair, 17.5 per cent of the ownership, according to reports filed with the Car Service Division of the American Railway Association. This was a decrease of 479 compared with the number on Feb. 15.

Of the total 6.047 or 9.4 per cent needed classified repairs, while 5,257 or 8.1 per cent were in need of running repairs.

Class 1 roads had 53,127 serviceable locomotives, an increase of 449. They repaired during the last half of February 22,457 locomotives compared with 22,292 in the first half.

Notes of Washington Activities

By Paul Wooton

The essentiality of the trade association and of trade statistics was pointed out in an address by Nathan B. Williams, associate counsel of the National Association of Manufacturers, before the annual convention of the Refractories Manufacturers' Association at St. Louis, March 19. Among other things, Mr. Williams said:

"Trade associations are tools of industry. There are those who would outlaw them. Being tools of industry, they must be kept in condition in order to perform their proper and useful functions. They are, of course, like all tools subject to misuse.

"The trade association is the primary source for accurate information respecting a particular industry or trade. By means of the association, not only is the industry and its constituent elements informed, but the public as well is made aware of that essential information which must necessarily be known in order that both business and government may function successfully. The trade association is the legitimate, the obvious and the fundamental agency, to gather, prepare and disseminate this information.

"The collection and publication of unidentified current trade statistics are not unlawful. Trade statistics and other trade information may be misused, and when so misused, subject those who perform such illegitimate use, to the pains and penalties of the laws in such cases made and provided.

"My advice is that legitimate trade associations continue their statistical and other activities without reference to the correspondence between the Attorney General and the Secretary of Commerce; that in conducting their activities they be careful not to transgress the well known inhibitions of existing law, in that they do not misuse their statistical and other trade information in promotion and furtherance of any agreement or conspiracy to fix prices, limit production, restrict sales, divide territory, or otherwise restrain lawful competition in commerce."

Some Way Out

It is believed some way can be found to secure from the administration a definite statement of policy in connection with trade statistics. The position of the Secretary of Commerce is generally known. His efforts to clear up the situation thus far have been futile, as is indicated by his correspondence with the Attorney General. It now is suggested that one of the coal trade associations might be able to secure a pronouncement of administration policy were it to make a very definite offer to the Department of Commerce to furnish it with its full statistical reports. The offer would be accompanied by a specific statement that it did not expect any guarantee of immunity from prosecution. It would be made plain that the issue is being raised to develop a method of making the information available so as to comply in the fullest degree with the law and with the hints which the courts have given that any information gathered must be made available to all concerned on equal terms.

With the committees of the House and Senate widely at variance on important features of permanent immigration legislation and with many individual plans being put forward by members of the two branches of Congress not members of the immigration committees, considerable doubt is expressed in Washington regarding passage of a bill before the expiration of the temporary 3-per-cent quota law on June 30.

Opinion indicates that the probabilities are that unless there is a speedy agreement on the form of permanent immigration legislation Congress will adopt a resolution extending the present temporary law for another twelve months, thus giving additional time to thresh out a permanent policy.

Export Managers Hold Meeting

Problems that are met by export managers in all branches of business including iron, steel, machinery, machine tools and allied lines, were discussed at the annual Get-Together Meeting of the Export Manager's Club of New York that was held at the Pennsylvania Hotel, March 18. An unusually interesting program had been arranged and the speakers each presented a different phase of the exporting business.

W. R. Cummings, vice-president on charge of sales for the Monroe Calculating Machine Co. acted as chairman of the morning session and the address of welcome was made by A. Schoonmaker, president of the club and export manager of the Bourne-Fuller Co. F. K. Rhine, general export manager of the General Fireproofing Co., was the first speaker taking for his subject, "Formulating Policies to Meet New Conditions." Kerro Knox, director of sales for the H. K. Mulford Co. spoke on "Helping Dealers Move Stock," and Paul R. Mahony, director of foreign sales for the Wahl Co. spoke on, "Local Advertising in Foreign Markets."

P. B. Deane, export manager of the York Safe & Lock Co., who was to have presided as chairman at the afternoon session, was unable to attend the meeting due to illness and his place was taken by E. B. Filsinger, of the Lawrence Co.

James S. Martin, foreign publicity manager for the Remington Typewriter Co., was the first speaker at this session. His subject was, "Sales Quotas and Contests in Foreign Markets." "Adjusting Credit Practice to Present-Day Problems" was discussed by J. L. Thompson, credit manager of the Yale & Towne Manufacturing Co. The afternoon session was concluded by a round table discussion on the demand for consigned goods and the questions that had been placed in the question box during the day.

Dr. Julius Kline, director of the Bureau of Foreign and Domestic Commerce, was the speaker of the evening at the informal dinner. He was introduced to the diners by President Schoonmaker and his remarks on export possibilities and potentialities were received with a great deal of interest by the members of the club.

Many of the trade directors connected with the Commerce Department attended the meeting and were at all times ready to advise with the export managers. Some of those attending were: Henry H. Morse, Arthur S. Hilyer, Richard F. O'Toole, Douglas P. Miller, Royal H. Miller, Frederic E. Lee, Lynn Meekins, Perry J. Stevenson and Albert J. Barnaud.

Revisions Made in Screw Thread Report

The revision of sections 1, 2, 3, 4, 5 and 9 of the report of the National Screw Thread Commission practically was completed at a meeting of the commission in Washington March 18 and 19. Section 6 requires further revision. Section 7 will have to be considered at another meeting and work still is to be done on section 8. The various sections which make up the commission's report deal with the following subjects:

Section 1, introduction; section 2, terminology; section 3, screw threads for bolts, nuts and commercially tapped holes; section 4, screw threads, of special diameters, pitches and lengths of engagement; section 5, hose threads; section 6, pipe threads; section 7, threads used in the electrical industry; section 8, machine screws and stove bolt proportions; section 9, wood screws.

Of the appendices, three are still to be whipped into final shape. One of these deals with the future work of the commission, another with the derivation of tolerances, and the third, measurement of pitch diameters.

The commission will meet again April 16. There is some prospect that the remaining sections and the appendices can be perfected at that session and the report sent to the printers.

Official Figures on Auto Output

Department of Commerce figures show February production of motor vehicles totaled 367,435 against 276,934 in February, 1923, and 122,521 in February, 1922. Passenger vehicles produced in 1924 were 336,363 against 254,773 in 1923 and trucks 31,072 against 22,161.

February output showed a gain of 49,061 passenger cars and 2,226 trucks over January.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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THE most important economic news published last week seems to have escaped notice. It is a report from the Federal Department of Labor based on reports from 8,222 establishments in 52 industries. It shows that during February there was an increase of 6.7 per cent in pay roll totals, an increase of 5.4 per cent in per capita earnings, and an increase of 1.2 per cent in the number of persons employed. If these figures are worth anything they indicate that there is work at good wages for every one.

Another important happening is the decline in the money market. Call loans have been made at 2 per cent and the rates for time loans and commercial paper are appreciably lower.

This combination—work in plenty at good wages and cheap money—is hard to beat. It is of the very essence of prosperity and has made the markets practically insensible to the political revelations at Washington and the passage of a bonus bill by the House.

Of the bill so passed all that can be said is that it is the least objectionable of the measures proposed; that the country can easily stand the cost, estimated at $100,000,000 a year for 20 years, and that if the Senate and the President accept it, it will forestall and estop other demands that are much more extravagant.

Other noteworthy but less important developments include an advance in French francs to 5.14 as a result of the Morgan loan which is believed to have been made upon the assurance of the French government that it would accept the Dawes-McKenna proposals for the settlement of the reparations question. There is, in fact, a feeling that the plan has been practically completed and agreed to by all the governments who will be parties to it and that with its formal adoption Europe will enter upon an era of great prosperity. The French Senate has finally given Poincare the dictatorial power to raise taxes that he sought but it may be that he won't have to exercise it if the Dawes scheme is promptly announced and made effective. The confident tone of the London stock market seems to sustain this idea and most international bankers and merchants appear to be more optimistic than for some time. Meantime unemployment is decreasing in England, trade is improving and the shipbuilding industry in particular seems to have turned the corner.

Turning again to our domestic situation, it is gratifying to observe that the retail trade is practically the largest on record, that merchants everywhere have very small stocks and that the market for dry goods and cotton goods in particular is sustained by the multiplicity of small orders from the many distributors who still insist upon buying from hand to mouth. Wheat, corn, and rye have declined upon the resale of speculative holdings bought in the expectation—now abandoned—of governmental price fixing. But most farmers have sold their production and no one grieves much over the losses incurred by the speculators.

What's Doing in Industry

Business during the past week in the machinery and machine tool lines proved "spotty" in most parts of the country with the middle west leading in the volume of sales and the eastern section of the country slightly off from the two previous weeks of the month. Inquiries kept up at a good rate and the totals for both sales and inquiries for March are expected to be good. Predictions, however, are being made with reserve as there is an uncertainty felt in most centers.

Automobile production goes steadily on at record-breaking figures, but even here is heard a note of caution. There are vague rumors of over-production and a too-active demand for used cars to warrant present manufacturing schedules.

Iron and steel production was good during the week and the first quarter will end with unprecedented output, according to authorities.

General business throughout the country is excellent and employment figures are gratifying.

Extremely unsettled conditions exist in the stock markets. Many stocks of the automobile and allied lines reached new low quotations for the year during the past week and the general tendency was bearish on nearly all issues with heroic efforts made to stem the downward tides.

It is said that the income taxes paid in on March 15 indicate a substantial increase in profits and earnings for 1923, but the figures are not conclusive as most of those who had large payments to make held back 75 per cent in the hope that some reduction would be made before Congress adjourned.

In the security market the growing ease of money has been reflected by a slight advance in bonds and active competition for the $45,000,000 of bonus bonds to be shortly issued by the state of New York is expected. They will bear interest at 4¼ per cent and, as they are non-taxable, they will probably bring a substantial premium.

Marginal speculation in stocks continues dull and featureless.

The stock brokerage business is so poor that many retirements and consolidations are said to be under consideration. The market has completely lost the barometric character formerly attributed to it. Last week the railway stocks were firm, while the industrials showed more or less eccentricity.

But the only conspicuously weak group were the "motors" which were lower on the talk of a disappointing demand for new cars. It is said that there are too many "used cars" for sale.

The absence of speculation is the only thing that is wrong with the stock market and opinions differ as to whether this is regrettable.

Merchandise imports of $335,000,000 and exports of $367,000,000 in February left a balance of $32,000,000 in favor of this country.

It was almost exactly offset by imports of $35,000,000 in gold. Gold imports for January were $45,000,000, and for the 3 months ending Feb. 29, 1924 net gold imports were $264,000,000. To this must be added our own gold production of about $50,000,000 annually.

From these figures it is plain that we are attracting almost the entire gold production of the world. Thoughtful economists continue to ask "what will we do with all this gold?" The question has not yet been definitely answered, but there are many who believe that the growing ease of money is the precursor of a period of gold inflation. The weekly Federal Reserve statement shows a reserve rate of 80.8 per cent. The only change of importance is a decrease of $21,000,000 in the Reserve notes in circulation. They have probably been displaced by the gold certificates that are being paid out.

The Industrial Review

What the year has yielded and some predictions for next year's production

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Canada

The machine tool business in Canada is already benefiting from the recent large orders for railway equipment placed with the steel and equipment companies. The business is making steady progress, and sales during the past two weeks reached a larger volume than in the earlier weeks of the year. Inquiries for equipment are appearing more frequently, and dealers handling woodworking tools and machinery have received a large number of promising ones, with sales well up to expectations.

Car loadings, indicating the general volume of business, show increases of nearly ten per cent compared with last year.

The annual reports of the large industries of Canada are now being issued, and in them there is a general tone of improved business conditions. Large additions are being made to plants. The Canadian Car & Foundry Co. reports that orders on hand since Sept. 30 last, total around $20,000,000, the equivalent of the gross sales for 1923.

Reports from both Hamilton and Toronto are to the effect that industries in those centers are averaging from 60 per cent of capacity upward.

The automobile industry is furnishing a lot of business for subsidiary firms. With spring now close at hand dealers handling cars of standard make are facing a demand, it is claimed, that from every indication will eclipse any previous shortage in the history of the automobile industry.

The final returns of the net earnings of the Canadian Pacific and the Canadian National Railway systems for 1923 evidence a largely increased volume of freight movement. The latest orders by the Canadian National Railways include one placed with the Eastern Car Works at Trenton, Nova Scotia, for the construction of 200 box cars and 500 service cars.

Chicago

Industrial buying of machine tools and machinery continues about the same as last week and sales for the week, although confined largely to single tools, were in encouraging volume. A major portion of sales to the industrials were made from the floor. During the week two rather extensive lists of used machinery and tools were circularized to the trade by manufacturers who offer surplus equipment for sale. The sale of equipment formerly in service in plants that are being dismantled has retarded sale of new equipment for months. Even a large trunk line railroad purchased used equipment.

The Santa Fe Ry. has apparently put out its entire list and will commence buying in the near future. The list totals about 175 items. Several cranes are included. The New York Central R.R. has placed an order for a 30-in. planer. The Cleveland, Cincinnati, Chicago & St. Louis Ry. continues to buy against its recent list. The Canadian National Railways are in the market for considerable machine tool equipment and have also issued a list of machinery and tools wanted for the Grand Trunk Ry. shops at Battle Creek, Mich. The Missouri Pacific Ry., St. Louis, Mo., is preparing a list of machine tools wanted. The Chicago, Indianapolis & Western Ry., Indianapolis, Ind., is in the market for a No. 690 Chambersburg, or equivalent, motor-driven hydraulic wheel press. Steel mills in the Chicago district are contemplating purchase of machinery and machine tools and a few inquiries have been issued. The Pennsylvania has ordered a 7-ft. radial drill. The Great Northern Ry. is inquiring for a 30-ton locomotive crane.

Milwaukee

Production schedules of machine tool manufacturers in Milwaukee and vicinity have been enlarged upon to some extent, which is the most encouraging sign that has appeared in the metal-working machinery market since early last fall. The actual volume of new business has increased but slightly, it being the anxiety of buyers to get prompt delivery that contributed most to the enlargement of working forces. This has been especially noticeable among automobile shops. Orders from this source involve no large lots, and in many instances call for special types requiring considerable custom work in executing designs.

Local dealers say that March business will easily exceed that of February, which in turn was larger than in January. Sales in the month now closing are generally reported to represent the best business in at least eight months. Toolroom equipment is relatively in best demand, but floor machinery is coming steadily into better request. Replacement needs still dominate demands, but inquiry suggests that machine shops are now contemplating at least some additional capacity, being satisfied that the general condition of business is sufficiently substantial and prospects adequate in this direction.

While dealers have been experiencing fairly good trade in used tools, it is the relatively liberal supply of such equipment that has been acting as a check on the activities of manufacturers of tools. Heavy liquidation of machinery during the past two years has thrown a vast number of tools on the market. The recurring wave of liquidation through most of 1923 seems to have subsided and jobbers and dealers are now in a position of working down their stocks without backfill.

In the trade, general conversation carries a more hopeful air concerning the immediate future than it has in many months.

Detroit

"Spotty" conditions continue to prevail in the machine tool industry in Detroit as automotive leaders prepare for the largest year's business they haye ever experienced

From all accounts there is no evidence of any sharp decline in business among machine tool manufacturers, but in some cases orders are coming from unexpected sources.

Automobile production thus far this year, according to a compilation by the Standard Statistics Co., has run 35 per cent ahead of the corresponding period of 1923 and for the first quarter is expected to approximate 1,100,000 cars. If schedules for the second quarter are carried out, production during the coming period will probably reach 1,400,000. The total output for the first half of 1924, therefore, may be 2,500,000 cars, nearly equal to the total 1922 production.

New York

Dealers in the New York territory are unanimous in the opinion that March will prove a good month—as good as January and February of this year and well up among the best months of the past four years. Predictions for the future, however, are varied with the majority of the dealers cautious as to stating that the second quarter of 1924 will be as good as the first quarter this year or the second quarter of last year.

Buying during the past week was termed as fair with a tapering off from the first two weeks of March. Inquiries during the month have kept up surprisingly well and lists of requirements are still being circulated by railroads, big electrical companies and some industrials. Eastern automobile manufacturers are buying machine tools from time to time, but it is problematical how long this buying will last and this source of business is not considered to be as dependable as it was last month.

Used tools are selling in good volume and the call has been fairly heavy during the past week. It has not been a hard matter for the dealers in used tools to obtain good machinery.

Exporting keeps up at an excellent pace and most exporters are well pleased with the showing thus far this

year. Every effort is being made to maintain the pace as long as possible.

Japanese buying has not started to any degree, but manufacturers in the East are confident that purchases will be made during April. In fact this is the month that was predicted five months ago for Japanese buying.

Southern District

The Southern distributors report a decline the first half of March in the total sales volume as compared with February business, but as a whole conditions are fairly satisfactory and the outlook bright.

Heavier tools and equipment still are in active demand by the railroads, though sales since March 1 have not been as large as they were the first half of February. Inquiries, however, are about on the same basis, and expected to develop an increase in the sales volume the latter half of the month. Railroads are increasing their development program over the whole South, a number of additional projects having been announced the past two or three weeks by some of the larger lines, including increased shop facilities, etc.

The automotive industry is even more active than it has been, with January and February the two largest months in the history of the industry in the South. Inquiries from this source are very active, and both light and heavy equipment, but principally rebuilt and second hand, is selling well.

Smaller shops give promise of increased activity during the next month, but have not been very active buyers the past three or four weeks.

Road building machinery and equipment is quite active, with promise of a much better volume during this summer than in 1923.

New England

Improvement is shown by the reports of machinery and machine tool manufacturers in the New England district during the past two weeks. Many of the larger companies report that business during the first quarter of the year is good and that improvement can be seen over conditions that existed in this section of the country during 1923. One firm reported that business was better at this time than at any time since 1920, except August of last year. Much of the machine tool business is being done with automobile parts makers and radio outfitters, with general lines and special machinery also coming in for some of the prosperity.

As an indicator of business in Worcester, government figures show continued employment to be best in that city. Another barometer from this section is the fact that the Reed-Prentice Co. recently gave a luncheon to department heads in celebration of the best business enjoyed by the company since its organization. This business was done in February.

Reports show that business generally has improved substantially in New England during the last months.

Business Items

The Metal Saw & Machine Co., 40 Napier St., Springfield, Mass., has purchased the business of the Reliance Machine Co. of Boston and is now in position to furnish the Reliance oilless type of bearings and bushings.

The Ruggles-Klingemann Manufacturing Co., 200 Devonshire St., Boston, Mass., was recently appointed exclusive New England representative of the Uehling Instrument Co., Paterson, N. J., manufacturer of power plant instruments.

The Heim Grinder Co., Danbury, Conn., has been organized and has acquired the entire interest of the Ball & Roller Bearing Co. in the Heim centerless grinder and will continue to manufacture this machine. The following officers have been elected: Henry N. Flynt, president; Clayton O. Smith, vice-president; and Ferris M. Angevin, secretary and treasurer.

The J. A. Fay & Egan Co., Cincinnati, O., manufacturer of woodworking machinery, announces that a consolidation has been made whereby Michigan comes under the jurisdiction of the Chicago district sales office of the company, located at 208 South La Salle St., of which Thomas P. Riordan is manager.

The new factory of the Thompson Motor Supplies, Acton, Ontario, has been taken over by the Acton Machine Co., which will now manufacture the lines previously produced by both companies.

Department heads of the Reed-Prentice Co., Worcester, Mass., were the guests of President J. Verner Critchley at a luncheon recently to celebrate a record made in the month of February, when the company's shipments reached the highest peak since the war.

The plant of the Colburn Machine Tool Co., Franklin, Pa., idle since the firm moved to Cleveland several years ago, will be taken over by the Joy Machine Co., of Pittsburgh, manufacturing mechanical mine loaders.

The J. H. Krause Supply Co. has been incorporated in Rockford, Ill., for the purpose of manufacturing, rebuilding and dealing in machinery. J. H. Krause, F. W. Smith and Lillian Krause are the incorporators and the capital is placed at $50,000.

Obituaries

C. F. TUCKER, a member of the firm, W. W. & C. F. Tucker, Inc., Hartford, Conn., died recently following an illness of seven months.

H. D. MEGARY, managing director of the Consolidated Pneumatic Tool Co., London, England, died March 20 in London. Mr. Megary was born in Philadelphia and was 35 years of age. He had been connected with the Bethlehem Steel Co. until 1918 when he joined the organization of the Chicago Pneumatic Co. as assistant to the president and later was made secretary of the company. In 1921 he was transferred to the London company.

RALPH A. METZGER, aged 41 years, assistant sales manager of the Reeves Manufacturing Co., New Philadelphia, Ohio, died recently at his home.

JAMES MANSON, aged 60 years, assistant to the vice-president of the Canadian Pacific Railway, died suddenly in Montreal on March 7. Mr. Manson was born in Caithness, Scotland, and in 1883 came to Canada where he almost immediately entered the service of the C.P.R. at Winnipeg.

GEORGE ROBERT BUSHER, aged 60 years, died recently at his home in Chicago. He had been a salesman with the Chicago Belting Co., Chicago, for the past eighteen years and was well known in the industrial world. He was formerly with the Diamond Match Co. as general superinendent and is credited with having invented the paper matches in book form.

R. H. YORK, aged 60 years, president of the Berkshire Manufacturing Co., Cleveland, Ohio, died recently.

MATTHEW CHAMPION, general superintendent of the Champion Rivet Co., Cleveland, Ohio, died recently in that city. He was a brother of David Champion, president of the company.

Personals

JOHN A. CAMM, formerly president of the Western Iron Stores, Inc., Milwaukee, has been appointed general sales manager of W. F. and John Barnes Co., Rockford, Ill.

E. D. ALLMENDINGER, manager of the foreign department of the Black & Decker Manufacturing Co., Towson, Md., sailed for England on March 15. Mr. Allmendinger will remain abroad for several weeks in the interest of his company.

BRIG. GEN. GUY E. TRIPP has been re-elected president of the New York Post of the Army Ordnance Association.

EARL W. NORTHRUP, formerly sales manager of the J. W. Murray Manufacturing Co., Detroit, has been made assistant manager of the plant.

C. J. SMITH of Hamilton, Ontario, well known in railway and steamship circles, has been appointed executive assistant to SIR HENRY THORNTON, president of the Canadian National Railways.

J. E. BROWN, formerly with the Western Electric Co., has joined the organization of Pawling & Harnischfeger Co., Milwaukee.

CHARLES F. RAND of New York, chairman of the Engineering Foundation, has been elected chairman of the John Fritz Medal Board of Award.

CLARENCE BROWN of the Pitcairn Co. is the new president of the Pittsburg Valve & Fittings Co., Barberton, Ohio.

A. J. REDDY, who was superintendent of the forge divisions of the Packard Motor Car Co., Detroit, has been made manager of this division. W. L. GUNTER is now supervisor of the body, bonnet and wheel paint departments.

A. J. BARNES, New York manager of the Shepard Electric Crane & Hoist Co., Chicago, was elected vice-chairman of the Electric Hoist Manufacturers' Association at the annual convention held recently.

M. J. ALEXANDER, of Pittsburgh, president of the Pittsburg Valve & Fittings Co., Barberton, Ohio, for many years, has disposed of his interests in the company to his friends and business partners of the Pitcairn Co. of Philadelphia. Continued ill health is the reason given for Mr. Alexander's retirement.

MRS. F. P. MCBERTY, secretary-treasurer of the Federal Machine & Welder Co., Warren, Ohio, will attend the International Conference of Women Engineers to be held at Manchester, England, April 2 to 5.

RALPH BLAISDELL has been made treasurer of the Wickwire Spencer Steel Corp., Worcester, Mass., succeeding A. D. BERNING.

H. J. FULLER was elected chairman of the Electric Hoist Manufacturers' Association at the annual meeting held recently. He is connected with the Yale & Towne Manufacturing Co., Stamford, Conn.

E. H. WARNER has been appointed salesman for Connecticut, western Massachusetts, New Hampshire and Vermont for the Reed-Prentice Co., Worcester, Mass. His headquarters will be at 76 West Alvord St., Springfield, Mass.

WILLIAM H. EAGER was re-elected president of the Whitman & Barnes Manufacturing Co., Akron, Ohio. The other officers re-elected were: A. R. Hall and R. S. Carter, vice-presidents; E. A. Fisher, secretary and treasurer; and Karl Kendig, assistant secretary.

W. M. NEAL has been appointed assistant to the vice-president of the Canadian Pacific Railway to succed the late JAMES MANSON. Mr. Neal entered the service of the C.P.R. in 1902 as a clerk in the superintendent's office.

W. B. JAMESON, formerly superintendent of the Maxwell factory at Newcastle, Ind., and for the last three years general superintendent of the Earl Motors Manufacturing Co. at Jackson, Mich., has accepted a position as general manager of the east side plants of the Hydraulic Steel Co. at Cleveland, Ohio, according to word received by friends in Indianapolis.

H. C. OVIATT, formerly general mechanical superintendent of the New York, New Haven & Hartford Railroad, is now associated with the Standard Stoker Co. as assistant to the president with headquarters in New York City.

Many Companies Report Good 1923 Business

The American Bosch Magneto Corp. for the year ended Dec. 31, 1923, reported operating profits of $148,711, compared with $25,914 reported for 1922. After deduction of reserves and inventory adjustments, net profits last year were $94,075, equivalent to 97 cents a share, earned on 96,000 shares of no par stock, compared with two cents a share, earned in 1922.

The National Acme Co. for the year ended Dec. 31 last, reported net profits of $240,717, compared with a net loss of $805,010, after charges the previous year. Sales last year totaled $9,586,306, against $5,618,237 in 1922. Current assets as of Dec. 31 were $8,549,149 and current liabilities, $1,363,245.

Total sales of $255,177,000 reported by the Western Electric Co. last year, compared with $210,941,000 in 1922, represented the largest volume of business in the company's history, according to the annual report.

Net income after charges and Federal taxes was $8,919,513, equivalent after preferred dividends to $14.38 a share earned on the 500,000 shares of no par value common stock. This compares with $5,331,793, or $9.29 a share in 1922.

Unfilled orders Dec. 31, 1923, aggregated $94,951,000, compared with $62,-069,000 at the end of 1922. The report states that in all departments the prospects are for greater activity during 1924.

Of the total sales billed last year, $185,969,000 were to the Bell Telephone companies, against $158,614,000 in 1922; $65,713,000 to other domestic consumers,, against $50,340,000 in 1922, and $3,495,000 to the International Western Electric Co. for export, against $1,987,000 in 1922. The telephone department's total billings for 1923 were $198,537,000, an increase of $30,217,000 over the previous year.

MARTIN-PARRY CORP.

The Martin-Parry Corp. reports net sales of $5,951,166 for 1923, against $4,327,685 in 1922, and net operating income of $767,324, against $445,774. After crediting other income, and allowing for Federal taxes and miscellaneous deductions, there was reported net profits of $653,066 against $402,248 in 1922. The net profits for 1923 were equal to $6.53 a share on the 100,000 shares of stock of no par value outstanding.

The balance sheet shows inventories valued at $1,925,182, against $1,477,100; notes and accounts receivable $270,481, against $398,639, and cash holdings of $191,210, against $122,316. Among the liabilities were reported notes payable, $640,000, against $558,981, and accounts payable, $228,494, against $152,704.

The Westinghouse Air Brake Co. for 1923 reports net operating profits of $11,742,843, against $7,924,915 in 1922. After estimated reserves for taxes, depreciation and depletion, the net profits were $9,788,507, against $6,964,915 in the previous year. Net profits for 1923 were equal to $12.14 a share on the $40,208,044 capital stock, against $11.94 a share on the $29,150,190 capital stock in 1922. The profit and loss surplus on Dec. 31, 1923, after allowing for a stock dividend of $10,208,042, amounted to $10,368,864, against a profit and loss surplus of $15,183,985 at the close of 1922.

The balance sheet showed current assets of $34,419,489 and current liabilities of $5,751,275, giving the company working capital of $28,668,214. The current assets on Dec. 31, 1923, included $8,486,746 in cash; Liberty bonds valued at $1,908,324; accounts and bills receivable of $9,399,606, and inventory valued at $10,624,813. Accounts payable totaled $2,254,804; dividends payable aggregated $1,180,338 and $2,098,166 was set aside as a reserve for taxes.

WHITE MOTORS

The White Motor Co. and its subsidiaries report for last year net operating income of $7,898,281 and net profits of $6,964,665, after Federal taxes and all other deductions. The net income was equal to $13.93 a share earned on the 500,000 shares of capital stock of $50 par value. After payment of $2,000,000 in cash dividends the company reports $4,964,665 added to surplus, raising the profit and loss surplus to $9,425,739.

Forthcoming Meetings

National Metal Trades Association. Twenty-sixth annual convention. Hotel Astor, New York City, April 23 and 24. L. W. Fischer, National Secretary, Peoples Gas Building, Chicago, Ill.

American Gear Manufacturers Association. Spring Meeting. April 28, 29 and 30, 1924. Lafayette Hotel, Buffalo, N. Y. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Society of Industrial Engineers. Eleventh annual convention. Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

American Society of Mechanical Engineers. Spring meeting. Cleveland, Ohio. May 26, 27, 28 and 29. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association. Triple convention, May 19, 20 and 21, 1924, Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

National Association of Purchasing Agents. Annual Convention, Mechanics Hall, Boston, May 20, 21, 22 and 23. W. L. Chandler, secretary, 19 Park Place, New York City.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The General Committee of Division V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

American Society for Testing Materials. Twenty-seventh annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Week of June 23. C. L. Warwick, secretary-treasurer 1315 Spruce St. Philadelphia, Pa.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig-iron market easier in tone; demand limited to small tonnages; No. 2 foundry quotations nominal at $22.50@$23.50 per ton, Birmingham. Iron and steel scrap market softer. Steel prices, f.o.b. Pittsburgh, at a range of $2.25@$2.50 per 100 lb. for plates; $2.30@$2.50 for shapes and $2.35@2.40 for soft steel bars. Reinforcing bar market continues to show improvement despite softness prevailing in other steel items. Slight weakness in blue annealed steel sheets; black and galvanized firmer.

Non-Ferrous Metals—Copper, lead and zinc markets firmer, although copper is down ¼c., lead, ⅜c. and zinc, 1/10c. per lb. since March 14. Tin and antimony weaker. Aluminum up 1c. per lb. in New York and Cleveland.

Miscellaneous—Washed, white wiping cloths up ¾c. per lb. in New York; lard cutting oil slightly lower than week ago.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22.50@23.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	$2.90@3.00	4.34	3.75	4.00
No. 12	3.00@3.10	4.39	3.80	4.05
No. 14	3.10@3.20	4.44	3.85	4.10
No. 16	3.30@3.40	4.54	3.95	4.20
Black				
Nos. 17 and 21	3.70	4.65	4.45	4.70
Nos. 22 and 24	3.75	4.70	4.50	4.70
Nos. 25 and 26	3.80	4.75	4.55	4.75
No. 28	3.85	4.85	4.65	4.85
Galvanized				
Nos. 10 and 11	3.90@4.00	4.90	4.70	4.85
Nos. 12 and 14	4.00@5.10	5.00	4.80	4.95
Nos. 17 and 21	4.30@4.40	5.30	5.10	5.24
Nos. 22 and 24	4.45@4.55	5.45	5.25	5.40
No. 26	4.60@4.70	5.55	5.50	5.55
No. 28	4.90@5.00	5.85	5.80	5.85

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ⅛-in. to 1-in., O.D., weighing 0,17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
⅛	$0.09	50%	⅞	$0.16	35%
¼	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	8.35
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	3.90	4.30
Cold drawn flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.30
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.54	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	55@60%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.50
Tin, 5-ton lots, New York			56.75
Lead (up to carlots), St. Louis	8.75	New York	9.37½
Zinc (up to carlots), St. Louis	6.50	New York	6.90

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	28@29	30.00	28.50
Antimony (Chinese), ton spot	12.12½	13.25	10.25
Copper sheets, base	21.75	21.75@22.00	23.00
Copper wire, base	17.25	19.75	16.25
Copper bars, base	20.75	23.25	19.50
Copper tubing, base	23.75	28.00	23.00
Brass sheets, base	18.25	22.50	18.75
Brass tubing, base	22.50	27.50	20.50
Brass rods, base	16.00	18.50	15.75
Brass wire, base	18.75	22.50	....
Zinc sheets (casks)	10.75	11.00	....
Solder (½ and ½), (case lots)	39.00	41.50	30.00
Babbitt metal (83% tin)	60.00	66.00	48@52
Babbitt metal (35% tin)	28.00	22.00	22@25
Nickel (ingot and shot)	29.00	....	....
Nickel (electrolytic)	32.00	....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.00	11.50	11.50
Copper, heavy, and wire	10.75	11.00	10.75
Copper, light, and bottoms	9.75	10.00	9.75
Lead, heavy	7.75	7.00	6.00
Lead, tea	6.50	4.50	5.00
Brass, heavy, yellow	7.00	....	7.25
Brass, heavy, red	9.25	10.00	9.00
Brass, light	6.00	6.00	6.25
No. 1 yellow brass turnings	7.00	6.50	6.75
Zinc	4.00	3.50	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$24.30	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	20.20	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.20	$0.14
Cotton waste, colored, per lb.	.09@.12½	.17	.10½
Wiping cloths, 13¼x13¼, per lb	11.75	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb.	....	52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.50	3.50
Linseed oil, per gal., 5 bbl. lots	.95	1.08	.94
Lard cutting oil, 25% lard, per gal.	.55	.50	.67½
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber and duck:			
First grade	50%	50–10%	40–10%
Second grade	50–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag	....	.65	.60
Coke, prompt furnace, Connellsville	per net ton		4.00@4.50
Coke, prompt foundry, Connellsville	per net ton		5.25@6.50
White lead, dry or in oil	100 lb. kegs		New York, 15.00
Red lead, dry	100 lb. kegs		New York, 15.00
Red lead, in oil	100 lb. kegs		New York, 16.50

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0334
Cold finished shafting	per lb.	0.044	0.044	0.042
Brass rods	per lb	0.16	0.155	0.1962½
Solder (½ and ½)	per lb.	0.39	0.3675	0.37
Cotton waste	per lb.	.14@.21	.14@.21	.10@.13
Washers, cast iron (⅛ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.58	0.58	0.55
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	45%	45%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50–5%
1¼ and 1¼x3 in. up to 12 in	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	30%	$3.50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65–5%
Lag screws, coach screws	45%	.....	60–5%
Square and hex. head cap screws	60%	75%	70–10%
Carriage bolts, up to 1 in.x30 in.	35%	05%	50–5%
Bolt ends, with hot pressed nuts	45%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, 5/16 and smaller	65%	.....	.....
Semi-finished nuts, ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$4.00
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	4.00
Washers, round plate, per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.50	3.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.60	$3.75
Cone heads, ditto (net)	5.20	3.80	3.85
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.35	.....	0.15
½ in. diameter *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	$3.70 base

New and Enlarged Shops

Machine Tools Wanted

Ill., Belleville—Modern Die & Plate Press Mfg. Co.—36 or 42 in. New Era Bullard vertical lathe.

N. Y., Binghamton—Service Eng. Co., 211 State St.—bench lathe, electrically operated, with motor.

N. Y., Ilion—F. Korkisch, 48 Morgan St. (sheet metal shop)—power operated sheet metal shears, also forming rolls.

N. Y., New York—Logan Constr. Co, 15 Park Row—Saunders 8 in. pipe threading machine.

N. Y., New York—Ostra Corp., 9 Franklin St., W. B. Bary, Purch. Agt.—two No. 1 Garvin screw machines and two small power presses.

N. Y., St. Johnsville—Village, O. Williams, Pres—lathe, drill press and milling machine for municipal garage.

O., Cleveland—P. A. Geier Co., 540 East 105th St. (vacuum cleaners)—die casting, boring and polishing machines, also automatic turret, drilling and cutting machines, lathes, mortisers and welders for new factory.

Tex., Wichita Falls—Lone Star Tank Car Co., Box 1445—10 x 12 air compressor and tank; radial drill, 24 to 30 in. swing; combined shear and punch, ⅜ in.; 10 ton traveler and chain hoist.

Wis., Briggsville—South Side Garage Co.—air compressor, grinder, gasoline pumps and tanks.

Wis., Racine—Wisconsin Metal Products Co., c/o E. B. Funston Co., Archts., Janes Blk.—stamping presses for proposed $60,000 factory.

N. B., St. John—New Brunswick Power Co., M. A. Pooler, Mgr.—complete equipment for proposed plant for the manufacture of streets cars.

Ont., Arden—D. A. Barker (batteries)—bench lathe.

Ont., Lanark — R. W. Sargeant — drill, press and lathe for garage.

Que., Montreal—A. Poirier, 5374 Sherbrooke St., W.—complete equipment for garage and repair shop.

Machinery Wanted

Ala., Alexander City—Home Ice Co.—ice manufacturing machinery.

La., New Orleans—Robertson's Welding Service, 925 Poeyfarre St., W. M. Robertson, Purch. Agt.—electric butt welder, 1½ in. rod iron capacity.

Mass., Cambridge — Hingham Knitting Co.—3½ in. cylinder, 200 needle Wildman ribbers, automatic stop motion, two speed, double feed, dogless attachment.

Mich., Flint—Bd. Trustees Union School Dist., A. J. Wildanger, 909 Flint P. Smith Bldg., Secy.—wood and metal working equipment for proposed shops of $750,000 high school.

Minn., Minneapolis—Builders Sideboard Co., 115 North East 5th St. (sash and door, interior millwork)—woodworking machinery for proposed $100,000 plant (about Nov. 1).

Miss., Gulfport—Magnolia Hosiery Mills, C. M. Alderson, Mgr.—complete machinery and equipment for mill.

Mo., St. Louis—Koehler & Son, 717 North 4th St. (printers)—paper cutter, bench shears and proof press.

N. Y., Bath—Boffa & Sherer, F. Sherer, Purch. Agt.—laundry machinery and equipment, including mangles and ironer.

N. Y., Binghamton—Binghamton Candy Co., Inc., 149 Leroy St., R. R. Lacey, Purch. Agt.—machines for the manufacture of candy.

N. Y., Buffalo—J. Kunz, 670 Elm St.—machinery for wood-turning shop.

N. Y., Dunkirk—Bd. Educ.—equipment for manual training shop of proposed $500,000 high school.

N. Y., Elmira—Hancock Bakery, 411 Madison Ave., G. J. Stover, Purch. Agt.—bakery machinery and equipment.

N. Y., Elmira—F. H. Johnston, 306 West Church St.—refrigerating system complete with 10 ton daily capacity ice plant.

N. Y., Gloversville—Elite Glove Co., I. Moses, Purch. Agt.—leather cutter.

O., Cleveland—A. Abell, 1556 East 86th St. (dairy operator)—pasteurizing machinery, a.c. motor and two ice making machines.

O., Columbus — Somers-Benbow Lumber Co., 483 Neilson St., D. S. Benbow, Mgr.—planer.

Pa., Wellsboro—S. M. Townsend Co., 17 Pearl St. (garage)—20 in. vertical post drill.

Tenn., East Chattanooga — Andrews Printery, Dodson Ave.—printing presses for addition to plant.

Tenn., Manchester—C. Sears—woodworking machinery, including planer and matcher.

Tenn., Tracy City—Tracy City Harness Co., A. Henderson, Purch. Agt.—overhead and transmission equipment, punches, cutters, etc., for harness factory.

Wis., Deerbrook—Hirt Bros. Co. (sawmill)—heavy duty rip and bandsaws.

Wis., Elkhorn—Elkhorn Case Mfg. Co., B. E. Breidenbach, Purch. Agt.—leather stamping machines.

Wis., Fond du Lac—Rosenthal Woodworking Co., c/o A. J. Rosenthal, 52 East 11th St.—saw.

Wis., Milwaukee—Central Fdry. Corp., c/o H. Dehn, 406 Layton Blvd. casting machines, dippers and cupola for iron foundry.

Wis., Milwaukee—Sperry Candy Co., 171 Bway.—motor driven machinery for proposed $45,000 candy factory.

Wis., Racine—G. Pfleger, Route 1—refrigeration and bottling machinery for proposed $40,000 milk plant.

Wis., Sturgeon Bay—F. I. Pleck Co. (manufacturer of ice cream and diary products)—refrigeration machinery, several ton capacity.

B. C., Victoria—Dept. Public Wks.—receiving bids until Apr. 7 for coal and ash handling equipment for power houses at Point Grey and Essondale.

Ont., Aylmer—Brandon Mfg. Co., Ltd.—complete equipment for shoe factory.

N. B., Milford — **A. Cushing** — sawmill equipment.

Ont., Brockville — Brockville Steam Laundry, 92 King St., H. Wing, Purch. Agt.—machinery, dryers, etc.

Ont., Crysler—E. Desautel—press, chain hoist, air compressor, etc., for garage.

Ont., Fergus—W. G. Beatty—machinery for the manufacture of pumps and pumping apparatus.

Ont., Hallville — B. B. Black — bench planer, etc., for garage and repair shop.

Ont., Preston—Steel Shank & Specialty Co., H. W. Steel, Mgr.—wood and metal working machinery.

Ont., Smiths Falls—J. Davidson—cutoff saw, moulding machine, sander, etc., for planing mill.

Que., Montreal—Natl. Refrigerating Machine Co., Ltd., c/o M. Shulman, 83 Craig St., W.—complete equipment for new plant.

Metal Working Shops

Calif., San Francisco—D. O'Neill, 273 Mission St., had plans prepared for the construction of a 2 story machine shop on Natoma St. near 3rd St. Estimated cost $15,000. J. E. Krafft & Sons, Phelan Bldg., San Francisco, Archts.

Calif., San Francisco — The San Francisco Realty Syndicate, 240 Montgomery St., awarded the contract for the construction of a 1 story factory, to contain 180,000 sq. ft. of floor space, on 9th St. near Howard St. Estimated cost $45,000. Gruss Air Spring Co., Inc, 865 Post St., Lessee.

Conn., Waterbury—The Plume & Atwood Mfg. Co., 470 Bank St., had plans prepared for the construction of a 5 story, 50 x 150 ft. brass and copper factory. Estimated cost $130,000. Private plans.

Ill., Sterling—The Peerless Level & Tool Co. is having plans prepared for the construction of a 1 story, 100 x 127 ft. addition to its plant. Estimated cost $45,000. W. Harley, Jr., 32 North State St., Archt.

Ind., Bloomington — Showers Bros. awarded the contract for the construction of a 2 story, 150 x 160 ft. factory for the manufacture of refrigerators. Estimated cost $100,000.

Ind., Bloomington — The Standard Oil Co. of Indiana, Whiting, plans to build a 2 story, 150 x 200 ft. automobile service building and repair shop, at 501 North Madison Ave., here. Estimated cost $150,000.

Ind., Pendleton—The Indiana State Reformatory plans to build a machine and woodworking shop. Estimated cost $250,000.

Kan., Topeka—The Western Fdry., 201 Jefferson St., plans to build a structural plant. Estimated cost $60,000. Private plans.

Ky., Paducah—The Shelton Bros. Fdry. Co. is having plans prepared for the construction of a 1 story, 60 x 92 ft. addition to its foundry. Estimated cost $40,000. A. Jamison, Campbell Bldg., Archt. Noted Dec. 27.

La., New Orleans—Henry Ford, Highland Park (Detroit P. O.), plans to build an addition to plant on a six acre site, St. Bernard Parish, here. H. K. Monroe, Local Mgr.

Mass., Cambridge—The General Radio Co. is having plans prepared for the construction of a 3 story, 50 x 80 ft. plant. Lockwood, Greene & Co., 24 Federal St., Boston, Engrs.

Mass., Monson—The Rubwood Wheel Co. plans to build a 1 story, 60 x 300 ft. factory. Estimated cost $50,000. Engineer or architect not selected.

Mich., Detroit—The Bldg. Service Bureau, Archts., 301 Bway. Market Bldg., receiving bids for the construction of a 3 story, 114 x 115 ft. addition to plant for the Superior Safety Furnace Pipe Co., 6100 Hamilton Blvd. Estimated cost $100,000.

Mich., River Rouge—The Ford Motor Co., Highland Park (Detroit, P. O.), awarded the contract for the construction of a 1 story, 270 x 1260 ft. spring and upset building, here. Noted Mar. 6.

N. J., Plainfield—The International Motor Corp., West Front St., awarded the contract for the construction of two 1 and 4 story heat treating plants. Estimated cost $500,000. This corrects report in Mar. 6 issue.

N. Y., Buffalo — The Commissioner of Pub. Wks. will receive bids until Apr. 17 for the construction of an asphalt repair plant, including machine shop, etc. C. E. P. Babcock, Municipal Bldg., Engr.

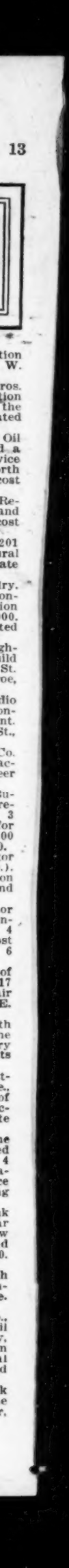
O., Cleveland—The Cleveland Wire Cloth & Mfg. Co., 3573 East 78th St., awarded the contract for the construction of 2 story (4 bays), 16 x 64 ft. each, addition to its factory. Estimated cost $50,000.

O., Cleveland—The Willard Storage Battery Co., East 131st St. and St. Clair Ave., had plans prepared for the construction of a 1 story, 80 x 135 ft. addition to its factory. Estimated cost $50,000. Private plans. P. H. Voth, Constr. Engr.

Tenn., Chattanooga—The Turnbull Cone & Mchy. Co., Fort and 14th Sts., awarded the contract for the construction of a 4 story plant for the manufacture of machinery for making ice cream cones and ice cream. Estimated cost $50,000, including equipment. Noted Jan. 24.

Tex., Fort Worth—The Lone Star Tank Co., Wichita Falls, plans to build a car repair shop on a 4 acre site on Saginaw Rd. along tracks of Atchison, Topeka and Santa Fe Ry., here. Estimated cost $75,000. Engineer or architect not announced.

Wis., La Crosse—Fox Bros., 129 North 3rd St., awarded the contract for the construction of a 3 story, 62 x 150 ft. garage. Estimated cost $150,000.

Wis., Racine—The E. B. Funston Co., Archts., Janes Blk., receiving bids until Apr. 1 for the construction of a 1 story, 100 x 248 ft. metal stamping factory on De Koven Ave. for the Wisconsin Metal Products Co., c/o Architects. Estimated cost $60,000.

N. B., St. John—The New Brunswick Power Co. plans to build a plant for the manufacture of street cars. M. A. Pooler, Mgr.